Electrical World

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The Gift of the Graduates

AT THIS time of the year our universities, colleges and technical schools pour out upon a sophisticated world crammed and parchmentized graduates by the thousand. Many of these enthusiastic and ambitious young men find their way into the electrical industry, because electricity appeals to them and because the industry is proverbially enterprising and alert. At any rate, it is the part of wisdom for the industry to welcome them and thus to keep renewing itself. By and large, it can find no better or more promising recruits than college graduates, possessing as they do "eager intellect and the adventurous spirit."

What if some or most of them lack much or any practical experience? This the industry will supply, and what it gives will be more than made up to it by the new viewpoint, push and daring brought by the man fresh from college. Idealism and socialism abound in these young minds, but they are advantages rather than disadvantages. There is something wrong with the college student who is not socialistic up to the age of twenty-three, and there is something radically wrong if he remains socialistic after that age. But idealism lingers longer and when directed into practical channels is a tremendous asset. The industry welcomes all it can get of practical idealism, for it is that which keeps it young and vigorous and protects it from the insidious and deadening effects of ultra-conservatism.

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An Infallible Index of Confidence

THE continuing strength of electric light and power securities in the great markets is a highly accurate index of popular confidence in the public utility industry. Massed attacks by politicians and sensational newspapers upon this industry have apparently had little effect other than to concentrate the attention of investors upon its growth, service and economic integrity. Report after report exhibits the earning power of operating properties to the stockholder and reader of the daily press, and the opportunities for expansion of service have already become a vital factor in popular appraisals of the worth of such securities today and tomorrow. Of course, there is speculation in such securities, and doubtless some overvaluing of prospects in the marketplace; but the ability of power companies to obtain fresh capital in the face of apparently biased investigations and unwarranted attacks by the ignorant and the unscrupulous is a truly extraordinary testimonial of popular regard. Saturation points in the use of electricity under scientific rate schedules seem as far away as ever. Measured against the present demand for utility securities, the vapors of demagogic appeal are clearly of little import.

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Engineers Review Progress

THE summer convention of the American Institute of Electrical Engineers, held at Swampscott, Mass., last week, was notable for a group of technical committee reports that surveyed the several fields of engineering and for many papers that presented new developments in the art. It was made evident that the engineers are very busy these days and that the Institute is serving as a splendid rallying place for their social and technical activities.

Not many years ago the Institute was composed largely of engineers engaged in machine design and manufacture, and the meetings served largely as a forum for discussions on machinery developments. Today the Institute programs show a breadth and diversity that fit changed conditions and are responsive to new developments in the art and in the industry. The eighteen technical committees bear such labels as transportation, transmission and distribution, power generation, electrophysics, instruments and measurements, protective devices, general power applications, communication, and so on, showing the broad scope of the work.

Several new developments were described at Swampscott. An interesting symposium was presented upon a new utility connection scheme wherein all generators are synchronized and connected directly to the load grid or network. This system is not applicable to all properties but has many advantages for certain types of metropolitan power systems. Another symposium was devoted to the subject of shielding against external fields in making electrical measurements, and many constructive suggestions in this direction were made. In communication a new master reference system was described that will have an important bearing on the future of that art. Other papers dealt with new things in machinery, in the application of automatic equipment and in a more efficient use of present equipment.

Special mention should be made of the reports of the technical committees. These surveyed the present status of the art and told of new applications. Any electrical engineer will be repaid abundantly for the time required to read and study these reports, for they give an intimate and authoritative digest of all aspects of electrical engineering. A noteworthy feature of the reports was the accent placed on economics. The engineers are seeking dollar efficiency as never before. It is difficult indeed to have a detailed knowledge of all branches of electrical engineering in this day of specialization, but all electrical

engineers can grasp the salient ideas and trends in all branches of the art through a perusal of these excellent reports.

The Institute is a needed agency in holding together the professional electrical engineers. It gives opportunity for the specialists to meet as a group to discuss their problems, and at the same time it serves as a unifying agency to weld together all electrical engineers into a professional entity. Moreover, it develops a sense of civic responsibilities and of the higher values in life so well outlined by President Schuchardt in his address. Any one who attended the Swampscott meeting came away with renewed loyalty and enthusiasm for the Institute and with the knowledge that the electrical engineers are continuing the work that is fundamental to the growth of the industry.

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Why Go to Europe for New Ideas?

AN ANNOUNCEMENT is often made to the effect that "So-and-so" has gone to Europe to study new developments. The frequency of such notices has raised the question, "Why do American engineers go to Europe for new ideas?" Evidently they get new ideas or they would not go on these business trips. Either the European engineers are more original in developing ideas than American engineers or certain economic factors in the European situation force this development.

European engineers have made valuable contributions to electrical development. A few of these are metal-clad switchgear, wireless transmission, paper-insulated cables and the steam turbine. Yet American power engineers who have visited Europe recently report that central-station development and the applications of electrical power have progressed more rapidly of late years in this country than abroad. If this is the case, one is puzzled by the fact that many new ideas both in power equipment and in electrical machinery originated abroad.

Research has been and still is a predominating factor in the work of the great Continental universities. As a result, large numbers of highly trained and skilled research men are available to industry in the various European countries. Industries employ such men to solve their problems and to develop new processes and thus have available a means for constantly improving their methods.

Research in America cannot be said to be the predominating factor in American universities, and until recently industry was little interested in research. There was little demand for the skilled investigator in the past, and comparatively few took up this work in engineering. The recent interest in research should stimulate the development of new ideas in America.

The economic situations here and in Europe are radically different. Electrical developments have been so rapid in this country that engineers have been wholly occupied in producing and maintaining the equipment needed to supply the desired services. So many opportunities are presented to young engineers that progress to positions of responsibility and executive control has been rapid. The new commercial and managerial problems that arise with every change of position have absorbed the engineer's attention and have left little leisure for creative study and thought. Under such circumstances these engineers have turned to others for new ideas to commercialize and develop. Quite naturally, Europe has been a favorite hunting place for these ideas.

The European engineer enters an intensely competitive field when he leaves college and enters industry. Competition for jobs is keen and promotion slow. The engineer soon becomes familiar with his work and finds time for creative thought. He realizes that his best chance for rapid advancement lies in capitalizing his brain power by the development of new ideas and the production of new inventions. He turns his special attention to these fields and under this economic pressure develops the ideas that he offers to American visitors.

America has not been wholly lacking in the creative spirit, as is witnessed by our many outstanding inventions. Still, one will ask: "What can be done in America to encourage creative thinking and development?" The research idea has been sold to industry. It is not so clear that the graduates of American technical schools have been thoroughly imbued with the idea that earnest thought and study along creative lines are expected of them in future years. When our young engineers approach their life work with an intense desire to evolve some original ideas, then fewer trips will be made to Europe to study new developments.

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Soot and Census

IF A CENSUS pamphlet arrives on an editor's desk together with the grit and soot which have come in through the open window on a summer day, is there any logical connection between the two? Not in the sense of their joint arrival, of course, but can the census shed light on the source of the soot? Perhaps the trail may lead to something of interest to the electrical fraternity.

The booklet in question happens to deal with prime movers, motors and generators in American industries. It gives statistics also on coal consumption. It tells us that in 1927 our factories had 16,923,931 hp. in steam engines and turbines. On another page is given the coal consumption for the year, 219,332,178 tons.

The census specifically warns against the inaccuracy of using these figures for computing coal consumption per horsepower, because many industries burn fuel for other than power purposes. Only the most general conclusions can be drawn. Still, it can do no harm to trace the matter a little farther, if the limitations are not overlooked. Two industry groups ought clearly to be excluded—products of petroleum and coal and the iron and steel group. That leaves 11,297,623 hp. in steam engines and turbines and a coal consumption of 101,787,707 tons. The average is 18,000 pounds per horsepower-year. We begin to see where the soot comes from.

On the two generous assumptions that these prime movers carry full load during the entire working day and that they operate 2,400 hours a year, this consumption is equivalent to 7.5 pounds per horsepower-hour. The average consumption in public utility plants last year was 1.76 pounds of coal per kilowatt-hour. Roughly, a kilowatt-hour at the plant may be equated to a horsepower-hour at the factory. One pound of coal in an average utility plant, then, does the work of 4.25 pounds burned under the factory boiler. What becomes of the three and a fraction pounds that cumulatively pile up to 75,000,000 tons a year?

These billions of wasted tons, which may cost annually a third of a billion dollars, are our luxury tax for inefficiency, for incomplete combustion, the production of

smoke and soot, and for making pretty plumes of exhaust steam. And so the census has helped us not only to find the source of the soot but roughly to evaluate the cost.

It may be urged that some of the coal is used for heating. To bring the industrial plant and the central station to a parity, however, it will be necessary to show that three tons out of every four, the year round, are consumed in combating winter's chill, baking bread, burning brick, dyeing, supplying hot water and steam in the meat industry, and for similar purposes, taking the country as a whole. Among individual industries the manufacture of gas ought probably to be deducted, for it consumed 9,348,488 tons, while the steam horsepower is only 323,891. None the less, the fuel consumption for purely power purposes is evidently large. Per contra, in order to exclude those groups which use coal chemically, our analysis takes account of less than one-half of the total consumption and excludes from the picture 5,626,308 hp. in the omitted industry groups.

There seems to be a problem in national economics here, and food for thought for central-station men, the stacks of whose plants, presumably, are monuments to smokeless and dustless combustion.

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Shielding Investigations Should Be Encouraged

BAFFLING difficulties in the evaluation of shielding in connection with electrical measurements are gradually yielding to mathematical and experimental analysis. At the Swampscott convention of the A.I.E.E. last week a full session was devoted to this subject, and at its close the mobilization of engineering talent along a wide front was manifest in the attack upon the problem of obtaining better standards of equipment and procedure. Representatives of university, communication, governmental and commercial laboratories pooled their research knowledge in six excellent papers, and a definite advance in technique was apparent.

The atmosphere of this subject may appear somewhat rarefied to the engineer whose daily concerns bear upon the application of electricity to industry, commerce and domestic service. However, the study of accuracy in dielectric loss measurements is of great importance to the art of electrical engineering, and the same thing is true in relation to the shielding of instruments from the effects of electrostatic and electromagnetic fields in general. In the past a good many assumptions have been made relative to the efficacy of rough and ready methods of shielding, and much still remains to be learned as to the value of various schemes and the limitations of apparatus spacing with respect to interference from return circuits and adjacent conductors in the engineering laboratory. Occasionally obscure burn-outs of galvanometer coils and even the blowing of lighting fuses have followed breakdown tests on nearby cable sections, and it appears that the distribution engineer and industrial plant electrician now and then may be obliged to face the problem of surge prevention on interior circuits and to consider the possibilities of shielding if space limitations are restrictive.

The major importance of further study of shielding, however, lies in its contribution to increased accuracy of measurements, especially of quantities and values of a low order of magnitude, and in the testing of cables and high-voltage transformers for instrumental use in connection with power transmission. Internal shielding is coming to play an important part in the design of non-resonating power transformers and in ultra high-voltage equipment for research purposes. There is a fairly close tie between the profoundly technical interest of the physicist and mathematician in shielding problems and the progress of engineering toward the development of more reliable products, and for this and other reasons the encouragement already given to research in this field deserves to be vigorously maintained.

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"Talking Movies" Revolutionize Convention Procedure

A NEW note in N.E.L.A. geographic convention procedure was struck when, following the presentation of talking motion pictures at the Atlantic City convention of the national body, these ultra-modern program features brought the "high lights" of that convention before regional conventions in Minnesota, California and Washington State. The future use of talking motion pictures will undoubtedly revolutionize convention proceedings. Their possibilities are almost unlimited, and for speeches by sectional leaders addresses by men of national prominence in electrical and other fields will often be substituted.

Thus the caliber of geographic convention programs will be raised to a national standard, and the great rank and file of the electrical industry will be able to hear the messages of their leaders delivered in their own tones and with all their individual personality and forcefulness. These same word-of-mouth messages, as well as lectures, playlets, "skits" or other features, may also be brought before group meetings of power-company employees, electric clubs and other organizations. Their utilization will prove perhaps not the least useful among the marvels of the age in which we live.

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How Strong Is a Welded Joint?

THERE need be little doubt of the possibilities of establishing, with sufficient accuracy to satisfy the most earnest skeptic, just what the strength of joints welded with care and skill may be; but it is the poorly welded materials which are likely to fail—to the peril of the job and the detriment of welding as a new fabricating art. Futile indeed would be the establishment of values for "poorly welded joints," for while average results may be interesting, less worthy practices border upon that which must not be.

How may it be established that a welded joint superficially strong and suitable has really the penetration and fusion that is vital to its safe use? Will inspection be adequate or must we rely upon the honest artisanship of the welder? True, a good line weld can be distinguished by those familiar with welding practice, but careless workmen, inadequate supervision and a few failures may set back the rapid development of welded construction and give a bad name to a practice which, when properly pursued, is beyond honest doubting. Every welded joint should be made as skillfully as possible and passed only when beyond criticism. It would be desperately unfortunate if a too rapid expansion, improper training or carelessness were to imperil the future of so great an advance in construction methods.

Swampscott

Where A·I·E·E· Convened

June 24-28

SITUATED in a delightful spot fanned by the bracing sea air and adjacent to golf links, the new Ocean House continues to be a favorite meeting place for summer conventions. Seats of scientific learning, historic and scenic places, manufacturing plants or headquarters of several New England electrical systems are readily accessible when technical sessions are not crowded too close together.

The Engineer—
A Practical Idealist

By R. F. SCHUCHARDT*
President of the A.I.E.E.

THE history of mankind shows a successive rise and decay of great civilizations. Are we also, like former ages, unable to bear up under prosperity and power? Earlier civilizations existed on relatively small areas. Today the entire world is a neighborhood —made so largely by the work of the engineer. Not only is it a neighborhood world but also a much more densely populated world. The engineer, responsible for so much that *is*, cannot shirk his responsibility for correct guidance of what *shall be*.

Our civilization has come to be known as the Machine Age, and as such it is both lauded and condemned. Glenn Frank, president of the University of Wisconsin, says:

". . . the masses have more to hope for from great engineers, great inventors and great captains of industry than from the social reformers who woo them with their panaceas. The greatest social progress of the next fifty years is likely to come as a by-product of technical progress."

Even in the Orient, where the materialism of the Occident is thought to sound the deathknell of the spiritual, we find the famous Chinese philosopher, Dr. Hu Shih, in agreement, for he sees science and the new technology as the forces which restored to man a sense of self-confidence and thus created the modern civilization of the West.

A False Sense of Security

We are vitally concerned with the provisions for living and for advancing civilization while man's neighbors are crowding closer and closer. The marvels of science have lulled the layman into a false sense of security. They have given him faith to believe that with the scientist and the engineer on the job the future will take care of itself. Perhaps it will, but only if the thinkers and the doers of this generation and those who follow put themselves earnestly to the task.

How does the engineer picture the future city? Is it to be a mechanical Colossus full of ingenious provisions for commerce and industry, for housing and for getting about, or will it be a place where man still has some contact with nature? Can a life develop properly when shuttling in crowded cars, through crowded streets or supercrowded subways, between an office which sees the sun for twenty or forty minutes a day and an apartment home in a high building closely touching elbows with neighboring high buildings? Is there a social problem involved in such city building and has the engineer no concern in it?

Our physical surroundings, things we can change if we will, offer a fertile field for the interest of engineers

**A condensation of his presidential address at Swampscott last week.*

"We are worthy possessors of our heritages only if we give thought to the morrow, and plan a richer life for our children."

R. F. Schuchardt

with their vision and with their desire for lifting life to higher levels. I suggest that we give more study to this and similar city problems and that we occasionally discuss them at Institute meetings, especially in our metropolitan sections.

Some Concrete Problems

Let us consider some of the problems that are, as it were, at our elbow. One is that of automobile engine exhaust in our cities, which has received all too little attention. This presents a serious health problem in the deep canyon-like streets. Let us in passing note the factory and the apartment house chimneys that still frequently belch forth dense clouds, often robbing man of beauty and of health. The engineer has provided a partial cure, but even our giant power stations, which receive the most expert engineering attention, still leave something to be desired.

There is another handicap to which little thought is given, the deleterious effect of noise on the nervous system. . . . And how much are we interested in the backyard regions of our industrial cities? Many of these reflect little credit on our advanced civilization. The appalling waste that this entails affects much more than our taxes.

Fortunately many cities, taking the lesson from the important European centers, have seen the wisdom of proper planning and are correcting misfits of earlier decades and are providing better guidance for the future. But the problem is today one of even greater extent—one of regional planning, and engineering enters largely into this also. In this and similar activities the engineer will seek the greatest dividends in terms of human happiness. . . .

Engineering analysis applied to human relations seeks to find the underlying laws. A study of past civilizations indicates that they failed because of violation of that basic social law which bids us do unto others as we would have them do unto us. Is it too idealistic to expect improvement in our day to come as a result of more engineering in government; that is, more of the engineering method applied to the solution of questions that tend to bring discord between peoples and between people?

Technical achievement has almost eliminated manual drudgery. The habit of technology to be guided by basic law holds our promise that "man's inhumanity to man" may likewise be banished.

Our machine civilization is still young and we can attribute to growing pains many of the conditions that today prevent man's best development. However, a look toward the horizon will show many encouraging signs.

Engineers at the Helm

Our country, appreciating the keen need of the time for the engineering approach to the important problems of state, has elected an outstanding engineer to the presidency. In other countries the engineer must similarly stand at or near the helm if this civilization is to survive. This does not mean that he alone is to be the savior of mankind, but in this age of co-operation the engineer, together with the doctor, the lawyer, the economist, the sociologist and other trained minds, must apply himself to a scientific solution of social problems in addition to furthering material development.

The engineer's work has started many trends in the direction of relief from some of the world's growing difficulties. A notable one is the spread of electric power into areas away from congestion, thereby permitting at least a partial decentralization of industries and of population. This spread is greatly advanced by the interconnection of power systems now so common all over the country, while the ease of getting about with automobiles is another important factor. A further material aid is the extension of electric distribution lines into rural regions so that modern methods can be applied increasingly to agriculture, both in the field and in the home, while the telephone and radio are keeping farm operators in touch with the latest in music and education. Great as the progress has been, much still remains to be done in these fields.

The good bishop of Ripon, with his suggestion of a ten-year holiday in science, sees but a small part of the picture and that not the bright and inspiring part. And our gifted sculptor Lorado Taft seems to feel that the progress made through technology expresses itself mainly in jazz. He fails apparently to see the poetry in the work of a Millikan, a Langmuir, a Steinmetz, or an Edison. He should see, as Pupin and others so clearly see, the idealism of the American machine.

The engineer with his enthusiasm over the human purpose of technology's accomplishments is guided by his ideal of a better living for man, but he keeps his feet on the ground in a practical effort to reach this goal step by step. That we are moving onward and upward I for one firmly believe.

Is not one true indication of the direction in which we are moving found in the growing appreciation of beauty? Art, which Henry James called "the shadow of humanity," is at last finding its place in the various branches of industry.

Our Institute, representing the electrical section of American engineers, offers the fellowship of kindred souls, a broadening of outlook and of knowledge, a blending of humanism with technology. It carries inspiration to its members to be not only technicians of high order but also trained seekers of the needs of mankind, applying their skill and their knowledge to the end that life for the teeming millions of their fellowmen may be made more worth while, less burdensome, more healthful, and more noble.

Thus, my friends, do I conceive the true engineer, one who in thought and deed is and ever will be a practical idealist.

Massachusetts Institute of Technology, One of the Institutions Visited by A.I.E.E. Delegates

A Symposium on

Synchronized at the Load*

General features of a new system connection wherein generators are paralleled at the load only. Principles. Calculations and tests

The Fundamental Plan—I

By A. H. KEHOE

Electrical Engineer United Electric Light & Power Company, New York

THE New York City 60-cycle power system is now operating with an arrangement of connection which gives paralleling paths between generating units only at the load. Each generator while in service on this system is described as being "synchronized at the load." This term refers to the conditions under which each unit is maintained in synchronism, but it does not refer necessarily to the initial synchronizing of one generator with the rest of the system. Fig. 1 shows a simplified diagram of the arrangement. Such a scheme of connections gives high reactance values for the synchronizing power circuits between the several generating units in comparison to the values which are in general use with generators also synchronized at the station bus. Nevertheless, the main energy channels between generators and the load have reactances, in respect to normal capacity of the same order as those usually experienced with metropolitan underground cable systems. Thus, while this arrangement does not fundamentally affect the normal power distributing characteristics of the system, it does improve system behavior during abnormal conditions in several ways.

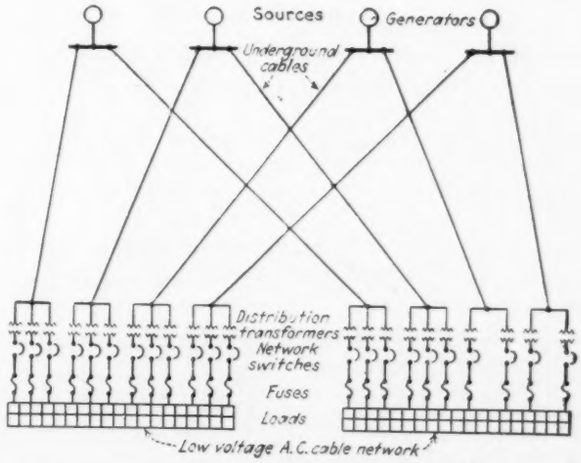


Fig. 1—Schematic Diagram of System with Generators Synchronized at the Load

IMPROVEMENT IN RELIABILITY OF GENERATING SOURCES

Investigation of the reliability of both the usual "loose-linked" and "tight-linked" systems made it appear that a generating station bus system providing parallel synchronizing paths would result in increased reliability to either a close-linked or a loose-linked system, with either ring or star bus plan. However, such an arrangement increased the switch-rupturing duty and the voltage disturbances on system faults. Furthermore, it did not simplify the protection problem.

In 1924, following two years' experience with the Manhattan multiple-feed alternating-current network system, the author proposed for maximum reliability to operate each generator in parallel with remaining generators only on the low-voltage network. This system uses the load points as a short-circuit-proof-paralleling bus for all the units which are "synchronized at the load." In applying the principles established by experience with multiple-feed low-voltage network distribution to a group of generators multipled only on a low-voltage network, it was assumed that if the system were stable the following desirable conditions would result: (a) Highly reliable sources of supply, since they were not affected simultaneously by faults; (b) positive back-up fault protection; (c) minimum fault current concentrations, and (d) minimum service voltage disturbances. The definite evaluation of the synchronizing power available and of the amount necessary to keep sufficient generating sources in step to supply the load under all conditions of system faults presented problems which prohibited the immediate application of such an arrangement.

The synchronizing power for the New York close-linked system with this arrangement was found to be

**Abstract of papers presented at summer convention of the A.I.E.E., Swampscott, Mass, June 24-28, 1929.*

adequate. While it is less under normal conditions than that which is obtained between individual units synchronized at the sources, yet the effective synchronizing ability at the time of a disturbance is approximately the same as with a close-linked system, due to the reduced magnitude of possible faults, and the new system has high reliability due to a multiplicity of independent sources. With a loose-linked system, the reliability of any district would not be dependent upon the synchronizing ability of the system, but upon that of a single station. For this reason the number of possible independent sources for any district will be less than with a close-linked arrangement, which is considered preferable to the loose-linked system if it is to be "synchronized at the load."

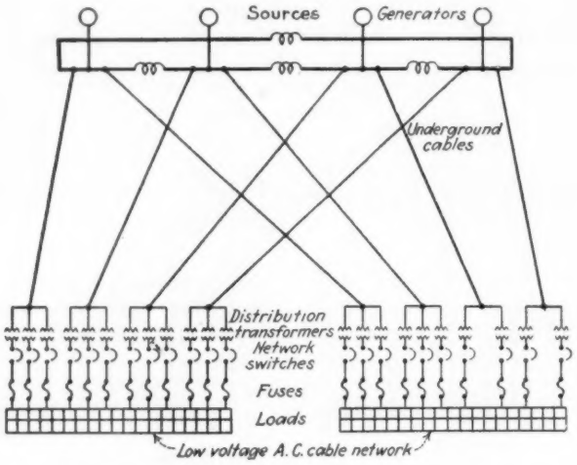


Fig. 2—Schematic Diagram of a Close-Linked Utility System

Reliability of Supply When Synchronized at the Load

The assurance of reliability of system supply for any one fault is secured by the following considerations: Sufficient generating sources are "synchronized at the load" on a system having ample synchronizing power between the units to produce stable operation between all sources for any single fault regardless of its location, provided the fault is eliminated promptly by protective equipment. As long as enough such independent sources are in service to maintain the load, the loss of the reserve part of the capacity will not result in an interruption, since the remaining capacity is not jeopardized by this loss. The ability of a low-voltage network to eliminate its own faults will provide positive back-up protection even though a reasonable percentage of subsequent failures of protective equipment do not eliminate the original fault. If a system has radial service supplied from a substation, the low-voltage bus, such as a 4-kv. substation bus, will be the last common load point and must be used for synchronizing at the load. In this case protective devices are relied upon for secondary protection, as there is usually a number of protective devices in series backing up each other for a major fault. In the extreme condition a fault which is not eliminated because the protective equipment failed will cause an interruption only to the substation where such failure occurs.

With a system synchronized at the load the current and load division between feeders may be affected somewhat except for peak conditions, when results should be the same. The magnitude of this effect, however, does not make it a major consideration. Similarly, the load from any generator (or bus section) should scatter to as many different load centers as possible in order to give the system the reliability obtained by diversity of supplies from a number of independent sources. If this is carried to extremes, the mean length of feeder will be increased unnecessarily. It is pointed out that all units do not have to feed each and every load point, and in the New York case we did not experience any increase in feeder lengths. It should also be noted that additional capacity can be supplied at lower installation costs because of smaller capacity required for electrical connections.

The arrangement makes the maximum short-circuit currents much less than are experienced on a system having a number of generators concentrated on a single bus. Furthermore, additions to system capacity do not increase the switch-rupturing duty beyond the amount required by the first installation as long as the same generating capacity is maintained on existing sections.

Since the magnitude of fault currents is materially reduced and since currents from all other units must feed through the load into the fault, the resultant voltage disturbances due to system faults are materially reduced. System service voltages during major faults approximating 60 per cent to 90 per cent of normal are to be expected instead of 20 per cent to 50 per cent of normal.

Conclusions

With ample synchronizing ability inherent in the system to give stability to a number of independent power sources, whether located in one or several different generating stations, generators synchronized at the load can be connected by supply feeders to a number of load points, thus making it impossible for one fault to affect all of the generating capacity; hence, if sufficient reserve capacity is in operation, the loss caused by a single fault cannot affect the reliability. By this method, reliability of supply depends upon having immediately available sufficient spare capacity in operation to compensate for a maximum number of possible major faults which are reasonably likely to occur in the interval required to get spare capacity in operation.

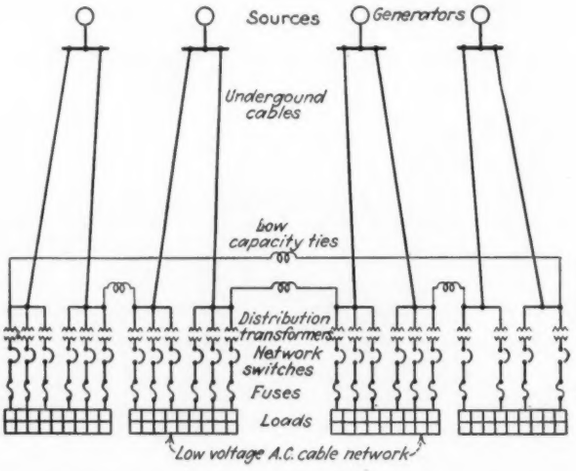


Fig. 3—Schematic Diagram of a Loose-Linked Utility System

Calculation of System Performance—II

By S. B. GRISCOM

General Engineer Westinghouse Electric & Manufacturing Company

IN GENERAL, the principal reason for synchronizing generators at the load is that it gives promise of increasing the reliability of power supply from the generating sources. The insertion of reactance not normally carrying current between generators does not affect the static stability of the system as a whole, but decreases the static stability of the individual generating units somewhat. The transient stability (relating to operation during disturbances such as short circuits) may be increased or decreased, depending upon the relations between synchronizing power and fault conditions for the two cases.

The fundamental plan of synchronizing at the load gives a redistribution of reactance on the system so that the reactance between machines and in series with faults is considerably increased. Fig. 4 illustrates in a schematic manner the connections which have been in use in the 60-cycle parts of the generating stations of the United Electric Light & Power Company and in the system external to them. The generating buses were tied to one another very closely inside the stations by bus-tie reactors and outside of the stations by cables at generator voltage. The stations themselves were directly tied together by high-voltage cables. Fig. 5 shows the same equipment but synchronized at the load, with the reactance between generating units considerably increased by the omission of the bus-tie reactors and interstation ties and by splitting the substation high-tension buses.

This scheme of connection is only partly equivalent from the stability point of view to a ring bus scheme in which high reactors are used between buses, since the actual ties between units consist of a large number of branches in parallel and because each generator tends to have symmetrical ties with each other generator. In fact, from this point of view the arrangement is more nearly like the synchronizing bus or Stott connection, but does not have any points where large amounts of energy are concentrated. The stability and reliability of the synchronized-at-the-load arrangement compared to the previous arrangement depends upon the relative amount of change in reactance in series with faults and between generating units.

The rigid requirements for power supply in a metropolitan area necessitate a system which has static stability under all conditions of operation, and transient stability under all conditions of operation with the exception that in some cases a disturbance may result in loss of a generating unit, and this is permissible, but it is required that the remaining units maintain synchronism with one another. In addition to possessing the necessary stability, there must be no undesirable hunting between generating units. The layout of the system is such that if stability can be obtained the requisite reliability of service will automatically be obtained, vulnerable points having been largely eliminated.

By static stability is meant that the generating units shall be capable of carrying the required load under normal conditions without loss of synchronism. With such a closely connected system it appeared likely that such would be the case, and the analysis of this point was made largely as a formality.

There are three transient conditions to be considered. One condition is a fault located more or less equidistant from each of the generating units, as (1) on Fig. 5. From the nature of the layout, it is apparent that such a fault affects all of the generators similarly and practically

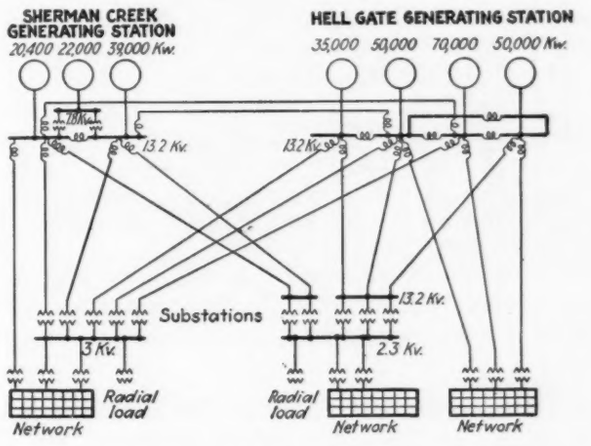


Fig. 4—Original United Electric Light & Power System with Generators Synchronized at Station Buses

in proportion to the size of the machine, hence would be almost unnoticed. Another condition is a fault on a feeder close to one generator unit, such as (2) Fig. 5. Practically, this condition resolves itself into a fault on the feeder side of a feeder reactor on one of the generating units. A fault at this location has a tendency to cause the generator nearest it to go out of step. The third transient condition is that of a short circuit on one of the generating bus sections as illustrated by (3) Fig. 5. This condition will almost invariably cause the loss of the generators connected to that bus section. However, it is required that only the remaining generators stay in synchronism with each other.

From the foregoing, it will be seen that the most important considerations from the stability point of view are that all of the generators keep in synchronism for short circuits on the feeder side of a feeder reactor, and that all of the generators except those directly involved stay in synchronism during a bus short circuit. The three-phase short circuit is the most severe, and has therefore been made the basis of study.

METHODS OF ANALYSIS

The general methods of calculation have been described in several papers before the Institute and details will not be given here. In all calculations the load was considered as a shunt admittance. This assumption was necessary because of the amount of work which otherwise would have been required, but it is probably fairly accurate for

the system under consideration because of the relatively large amount of lighting load. For the static stability analysis the synchronous reactances of the generators at the initial operating points were used. For the transient analyses the transient reactances of the generators were used. The effect of variations in the cross-flux was not considered. Measurements can be made on the calculating board which will permit reducing the complicated network to the minimum number of branches. In general, any network can be reduced to a mesh in which there is a branch connecting each terminal point with each other terminal point, and this form of representation will give the smallest number of branches that can be used and still represent the original network exactly so far as analytical considerations are concerned.

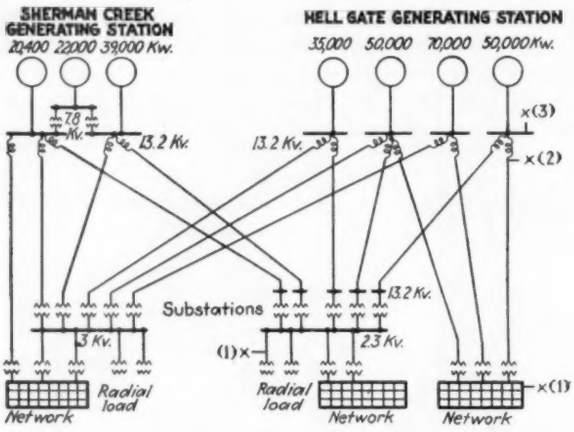


Fig. 5—The United System Rearranged for Generators to Be Synchronized at the Load

After having obtained the reactance of the network elements, values were substituted for the transformer capacity connected to the various cables. The effective reactance between the generator to be tested and the remainder of the system, through the network, was found. Resistance components were then added to the reactances according to what was considered to be the probable ratio of resistance to reactance. Admittances were placed along the connecting impedance between the two generating sources in proportion to the probable electrical distances of these loads from the sources. This gave a static network to which it is only necessary to add the generator reactances in order to proceed with the analysis of operating conditions.

The synchronous reactance of the generator under test and the remainder of the generators grouped were added at the proper ends of the connecting network and, with the internal voltages determined in accordance with the initial loadings, completed the data necessary for obtaining a static power-angle diagram.

When the transient reactances of the generators were added to the ends of the network the total impedance to the flow of synchronizing power was found to be 60 per cent on the generator rating. Because of the shunt load, however, the maximum point on the transient power-angle diagram is considerably in excess of the value corresponding to 60 per cent impedance and corresponding allowances must be made.

In Fig. 6 are shown measured and calculated curves of angular swings. The measured curve was obtained from the oscillographic measurements with a small correction for the internal angle of the generator, while the derived curve was obtained from the derived system characteristics, and the measured variations in power output. Considering the manner in which the determinations are interleaved, this figure indicates a fairly good over-all check.

It is interesting to note that the generator had a short-circuit ratio of 0.76, and despite the fact that there was an instantaneous symmetrical three-phase short circuit of about 2½ times full load on the generator for 1.8 seconds and a relatively weak tie to the remainder of the system the generator remained in step. The initial load was approximately 60 per cent of rated load at rated power factor and no automatic voltage regulators were in use. These figures show quite clearly that high short-circuit ratios are not required of turbo-generators for power supply in relatively closely connected systems.

Design Constants

From the studies and tests made thus far the following values are suggested as reasonable for system design:

Synchronizing Ability Between Generators—The impedance between the internal voltage of one generating unit and the internal voltage of all other units of the same system in parallel (not including ties to other systems) should lie between 40 and 60 per cent, based on the kilovolt-ampere rating of the generating unit.

Synchronizing Ability Between Systems — The impedance between two systems both of which are synchronized at the load should not exceed 200 per cent on the rating of the smaller of the two systems.

Short Circuits — The maximum instantaneous symmetrical short-circuit current on a feeder from a generating unit should not exceed 2½ times the normal current capacity of the generating unit and should not be permitted to last longer than 1½ seconds. For simplicity this value should be obtained on the basis of a short circuit with the highest capacity feeder reactor in series with the generating unit on a three-phase short circuit. For higher values of short-circuit current the duration of short circuit must be reduced.

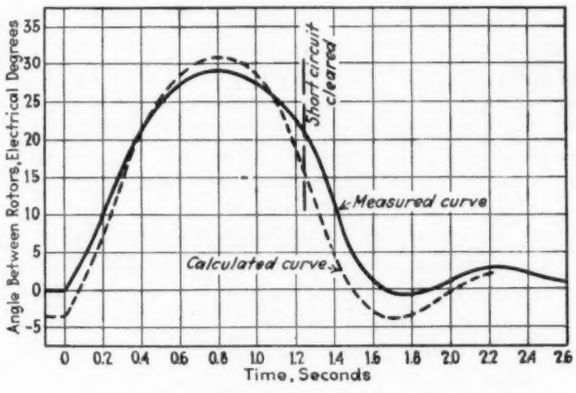


Fig. 6—Measured and Calculated Angular Swings of Generators for One Test Condition

Circuit Breaker Capacity — With the above system proportions the interrupting duty on a generating unit breaker will not, in general, exceed 1¾ times the generator short-circuit current.

System Tests and Connections—III

By H. R. Searing and G. R. Milne

Assistant Electrical Engineer and Designing Engineer, Respectively, United Electric Light & Power Company

IN ORDER to check the predictions and calculations and to furnish a basis for operating all generating units synchronized at the load a number of system tests was made. The proposed arrangement contemplated a system in which the only connections between generators would be those through the secondary network. While the system constants from the generator to the network were susceptible to accurate calculation, there was no information available as to the impedance of the secondary mains system, hence it was desirable to obtain test confirmation of the calculated values. This test was made on the Times Square network, covering 0.37 square mile, with a connected transformer capacity of 11,325 kva. supplied by eight distribution circuits. Two of these circuits emanating from a remote substation were out of service during the tests to simplify the determination.

Readings were obtained during light load periods in order to eliminate as far as possible the effect of customer's load. By manipulating the feeder regulator on one circuit while the regulators of the other circuits were kept in a fixed position, values of current, voltage and power of each circuit and various differential voltages for different regulator positions were obtained, which gave the average impedance.

After subtracting the impedance of the regulators, primary cable and transformers the impedance of the network from the transformer terminal points of any feeder to an imaginary star point was found to be 5.1 per cent based on the transformer kilovolt-amperes connected to the feeder.

The value of 5.1 per cent agrees reasonably well with a calculated value of 4.6 per cent for a similar case when it is considered that the calculations were made on a different network (Inwood) and the network under test was distorted by having two of its normal feeders out of service.

While this value will vary depending on the design of the network, it is felt that 5.1 per cent represents a high value, which may be reduced as the load density on the network is increased.

Stability

The test results showed that the generator was very stable when synchronized through the low-voltage networks, though the capacity of the connected distribution transformers was less than would be expected under normal system planning. No hunting occurred, and even with the most severe short circuit applied just outside the feeder reactors at the generating station for 1.8 seconds the stroboscope indicated a maximum shift of 40 electrical degrees lead between this machine and the remainder of the system.

Network Switch Operation

The tests demonstrated that when the system was operated so that the maximum kilowatt load imposed by a feeder short circuit did not exceed the normal kilowatt load on the generator network switches of the sensitive reverse power type remained closed even under the most severe condition of feeder short circuit. The voltage on the network was sustained at a value which precluded any network switches of the low-voltage release type from operating prematurely due to low voltage. During the test a maximum of 1.4 per cent of the network switches connected to the machine under short circuit opened and reclosed. These switches opened because the network load at that point was small at the time of test.

System Disturbances

On the networks which were partially supplied by the machine under test the voltage drop on short circuit varied from 10 per cent to 34 per cent. It should be noted that this drop was much larger than should occur in normal operation because in the test the network capacity was distributed in such a manner as to give the equivalent of a two-circuit network. In a normal set-up where one machine would carry only a third or less of the network capacity the voltage drop would be considerably reduced.

System Layout for Initial Operation

These tests demonstrate the stability of the arrangement for any disturbance beyond the feeder reactors and substantiated the general method of analytical treatment.

In planning the system layout for operating synchronized at the load it became apparent that the ratio of feeder capacity to generator capacity should be approximately the same for all sections, and that any substation or network district should be supplied from different generating station sections so as to maintain diversified feeds under all operating conditions. The first feature is desirable, not only for load division but in order that each generating section may carry its share of the system wattless kilovolt-amperes. The second feature is obviously necessary for service reliability. Furthermore, the feeder grouping and capacity must be such that generating units and also stations may be loaded to their economical point.

Breaker Duty Reduced

With the synchronized-at-the-load arrangement the duty on oil circuit breakers was reduced and one of the immediate advantages, aside from increased reliability,

Before and After Three-Phase Short-Circuit Current Values

Bus Short Circuit—Section 5-6—Hell Gate

Time	Synchronized at the Load	Synchronized at Generating Buses
Instantaneous Symmetrical	70,700	122,000
Instantaneous Asymmetrical	124,000	217,000
0.05	85,000	141,000
0.10	70,000	118,000
0.15	62,000	102,000
0.25	56,000	90,000
0.50	53,000	76,000
1.00	47,000	65,000
2.00	43,500	56,000

was the fact that maximum duty on these oil breakers would still be within their rated capacity. A comparison of feeder breaker duty before and after synchronizing at the load is shown in the accompanying table.

While the main synchronizing path is at present through the 4-kv. substation buses, a number of generating station feeders connect directly to the network. No difficulty has been experienced with the network switches, which are of the sensitive reverse power type.

The voltage of the system is considerably less affected by feeder short circuits under the new arrangement. The disturbances caused by faults on a high capacity feeder showed an average voltage drop of 9 per cent synchronized at the load compared with 20.7 per cent with the previous connections.

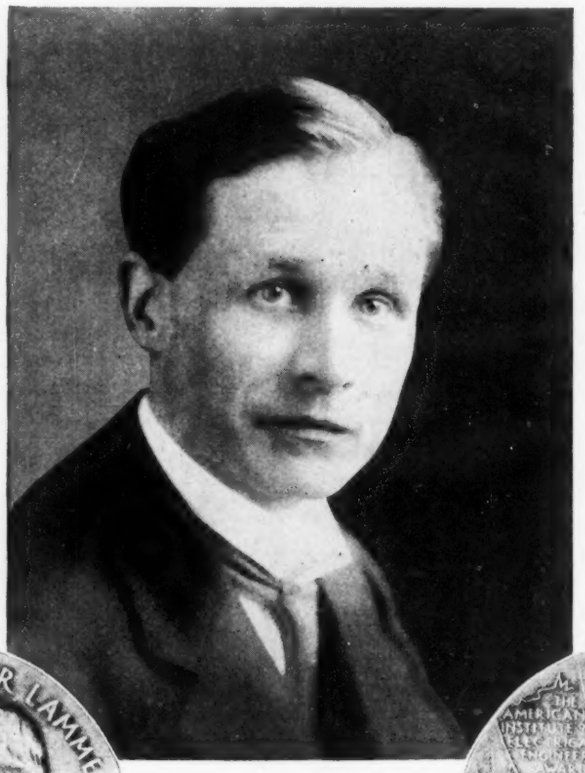
All generating units have operated in a steady manner both with normal loading and under a number of system disturbances. Records from the automatic oscillographs recently installed will give quantitative information as to system performance.

Test results have verified the calculations, and operating experience thus far has substantiated the predicted advantages of a system synchronized at the load, as described in the preceding discussion.

Lamme Medal Awarded

by A. I. E. E. to

Allen Bertram Field



ALLEN BERTRAM FIELD

Award was made for his mathematical and experimental investigation of eddy-current losses in large slot-wound conductors in electrical machinery.

IN LARGE electric generators, particularly those which carry large currents, there had been observed a curious excess heating which resembled that produced by a much higher frequency than existed. Mr. Field turned his mathematical training to this perplexing problem and discovered the striking phenomenon of excessive distortion caused by the peculiar configuration of the magnetic field in deep slot-wound conductors. Experimental investigations confirmed his theoretical results. His observations were presented before the A.I.E.E. in 1905 in a paper entitled, "Eddy Currents in Large Slot-Wound Conductors."

The significance of Mr. Field's work is indicated by quotations from three eminent engineers:

"The most important foundation stone supporting modern alternator design . . ."

"The methods for calculating eddy currents are the most important factors in the improvement of large electrical machinery."

"Without his findings many large units now existent could not have been developed "

Rehabilitation of

Steam Power Plants*

Guiding criteria developed. Suggested methods of attack. Discussion of variable investment and operating conditions

By C. F. HIRSHFELD

Chief of Research Department, Detroit Edison Company

IT IS practically impossible to set down definite rules or even guides regarding the rehabilitation of steam power plants. A few outstanding facts may, however, be indicated.

In most cases both improvement of thermal efficiency and increased capacity will be possible, and it is necessary at the start of the problem to consider which of these possibilities, if either, is to be favored. In general, increase of capacity beyond certain limits will be attainable only by sacrificing certain thermal possibilities and a clear picture of the relative importance of the two will assist greatly in steering a reasonable course through the maze of things that might be done. Usually the possibility of increased capacity should be given first consideration because certain limits to such increase are so easily discovered.

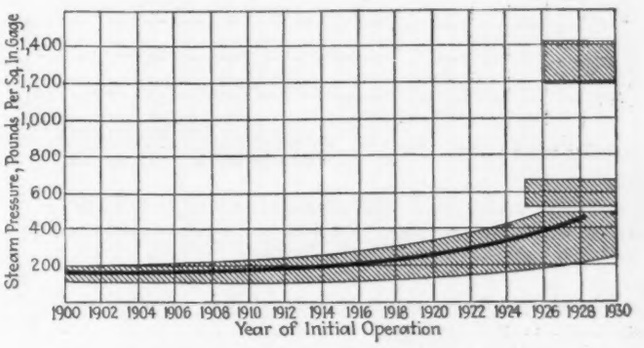
Thus, it would naturally be foolish to consider increase of capacity if the increased output could not be transmitted or distributed from the site in question. In many cases the available number of routes is limited and these may be found to be used to the limits of their respective capacities. Naturally this is logically the first matter for study.

If the power could be got away if generated, the next logical step is a study of those things which may limit ability to generate on that particular site. These would be primarily the quantity of water available for condensing purposes and the possibility of delivering the required amount of fuel. If all available water is now being used, as determined either by the supply or the size of canals that must be used, increased output can be obtained only as the steam rate can be reduced, or as the vacuum is permitted to become poorer and the thermal efficiency proportionately sacrificed.

If the water and fuel supply appear adequate the area of the site and area and cubical content of buildings come into consideration. Any of these may place unfortunate limitations on increase of capacity, but they are in general not so controlling as the other factors just considered.

Finally, the adequacy of existing switching equipment should be given attention. Any scheme which will permit the use of existing equipment would naturally stand a better chance of financial justification than one which required complete rebuilding of the electrical end of the plant.

With such possible limitations clearly evaluated, the most important decision in the average case and that on which all else may be said to hang is whether the boilers are to be retained or scrapped. If they are to be retained the operating steam pressure is limited to its earlier value except in those cases where a high-pressure unit is installed as an addition to existing equipment. This will be considered later. If the boilers are to be retained there is definite restriction of choice as to what may be done; on the other hand, there is the certainty of a smaller expenditure.



Increase in Steam Pressures

Shaded areas indicate limits and solid curve conservative good practice.

There has been much misunderstanding of the significance of high steam pressure. It happens that a very rapid improvement in the thermal efficiency of power plants has occurred during the same time that we have been stepping up steam pressures. As a result, many who are not familiar with all the details have come to assume that the first is entirely the result of the second. This is really far from a complete statement of the facts.

During the same interval we have increased the boiler room efficiency from values falling between 70 and 78 per cent up to values falling between 84 and 89. A change from 78 to 88 represents a fuel saving of almost 13 per cent.

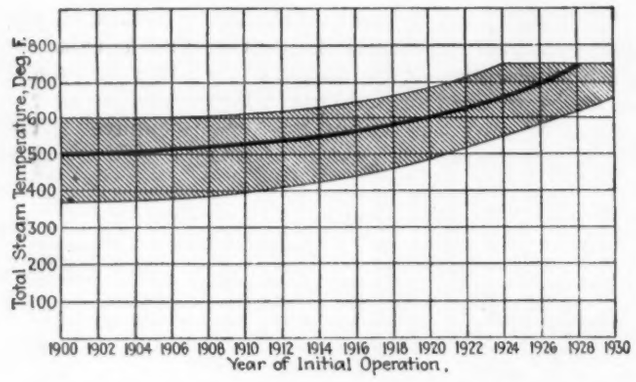
We have also adopted the regenerative cycle of operation: that is, heating of the feed-water in steps by

**Abstract of paper presented at the summer convention of the A.I.E.E., Swampscott, Mass., June 24-28, 1929.*

means of steam bled from the turbine. This represents a saving varying from 5 per cent to 11 per cent when referred to the coal pile.

It should also be noted that we have, in addition, increased the total steam temperature. In a period of about fifteen years we have gone from a total temperature of about 600 deg. F. to a total temperature of about 725 deg. F. This change of temperature is equivalent to a thermal improvement of between 4 and 5 per cent for the plant as a whole. During all this time the design of the steam turbine itself has been so improved as to result in a material reduction in heat consumption at any given pressure, temperature and vacuum.

It is therefore apparent that it is not correct to attribute all of the improvement in the thermal performance of the past ten years or so to increasing steam pressures, since many other factors have contributed. As a corollary it follows that in the rehabilitation of a station it may be possible to do much that will result in improvement of the thermal efficiency even though the original steam pressure must be retained.

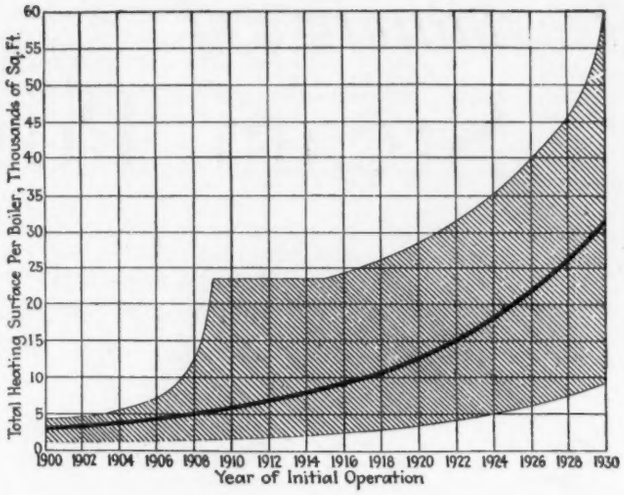


Increase in Total Steam Temperature

Shaded areas indicate limits and solid curve conservative practice.

The decision with respect to the use of higher steam pressure is not entirely confined to its effect upon the thermal efficiency because increased capacity can be obtained in this way through the use of comparatively small high-pressure turbines discharging into the old turbines, utilizing the old condensers. Therefore, while the boiler room investment would necessarily be high, this may be balanced by a comparatively small turbine room investment. The use of the old generators would also, in general, make it possible to use the old switching equipment, although there would naturally have to be additions to take care of the generators of the new high-pressure turbines.

Only one case is known to the author in which complete replacement of old boilers with new high-pressure boilers has been decided on. This is a very special case in which new boilers and turbines are being installed in the old buildings for the primary purpose of obtaining greatly increased capacity from a given site of restricted area. If it is a fact that this is the only case of this sort, it may be due to the comparative newness of high pressures. There are, however, several cases in which high-pressure boilers and corresponding turbines have been added to existing stations with the idea that they would carry the base load and thus take maximum advantage of the higher thermal efficiency produced. Such work is more properly regarded as



Increase in Physical Size of Boiler Units

Shaded area indicates limits.

extension of an existing plant than as rehabilitation of an old one.

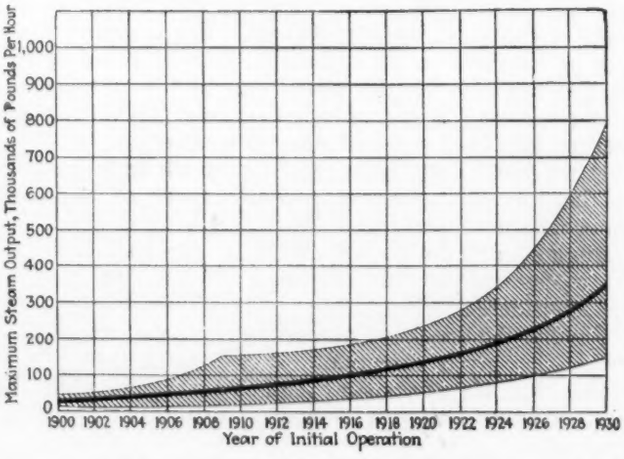
The majority of cases of rehabilitation have thus far fallen in the class in which the old boilers are retained, thus accepting the limitations set by the original steam pressure. At present, these are the more interesting and probably the more important.

Methods of Increasing Economy

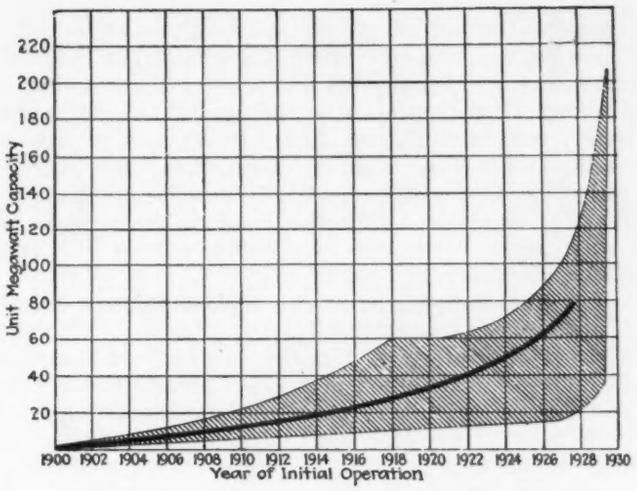
The following methods of attack are available in such cases:

1. The boiler room efficiency may be greatly improved without materially increasing the steam-generating capacity. This can be done by the use of more modern fuel-burning equipment of one sort or another, by the addition of economizers or preheaters or both, and occasionally by improved baffling of the boilers.

2. The boiler room efficiency may be greatly improved and, at the same time, the steam-generating capacity may be increased to a very great extent. It is not at all impossible to double or more than double the steam output of an old boiler room by using improved combustion equipment of greater fuel-burning capacity, while at the same time bettering the boiler room thermal efficiency through the use of economizers or air preheaters or both. It will generally be found advisable to use a certain amount of furnace wall cooling in such



Increase in Steaming Capacity of Boiler Units

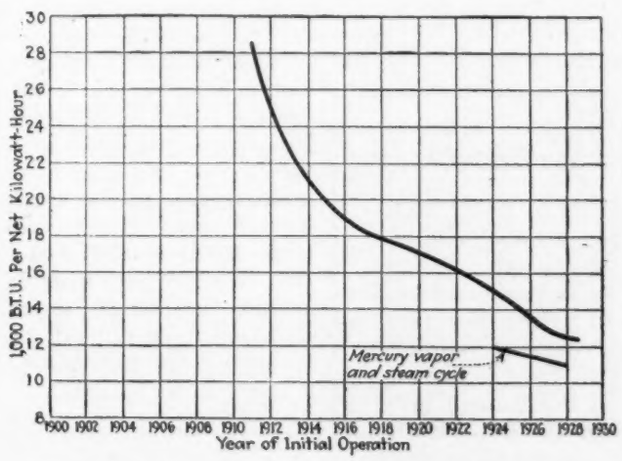


Increase in Main Unit Turbine Sizes

extreme cases so as to gain the increased output most easily and so as to hold in check the tendency toward increased furnace maintenance. In this connection it should be noted that it is frequently possible to obtain greatly increased furnace volume, by ignoring existing floor levels and by the utilization of modern ash-handling equipment which requires small height for its installation.

3. The turbine room efficiency may be increased by raising the steam temperature. This will naturally involve more superheater surface or at least differently located surface. In most cases the use of some sort of radiant superheater in series with the older superheaters will be found advantageous, but a careful study of pressure drop through superheaters and connections must always be made. This is of particular importance when the steaming capacity of the boilers is also increased. The adoption of higher superheat will usually involve minor rebuilding of the high-pressure end of the turbine and in some cases major rebuilding of that end.

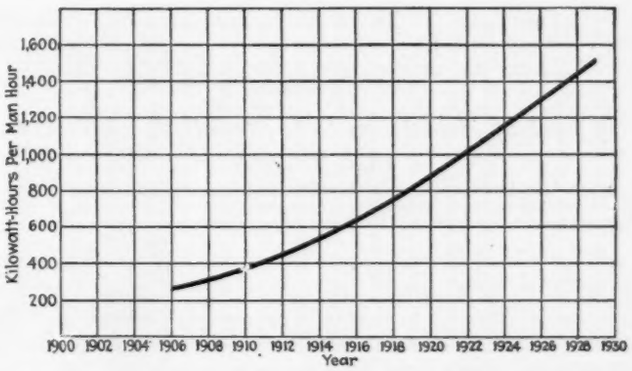
4. The turbine room efficiency and capacity may be increased by several different methods. The most obvious, but also usually the most expensive, is by the installation of new, larger and more efficient turbines taking steam at higher temperature from a boiler room of increased steaming capacity. When this method is adopted it becomes comparatively easy to introduce re-



Thermal Economy of Plants Operating on 50 to 60 per Cent Annual Load Factor

generative feed heating because the new turbine casings will be supplied with bleeder outlets. The improvement of thermal efficiency obtainable from regenerative heating can therefore be obtained readily. Larger condensers or additions to existing condensers may have to be provided. The old electrical switchgear can sometimes be used by adopting a double winding on the generators so that the capacity per switch is held within the old limitations.

A less obvious but very effective method of obtaining increased capacity and efficiency is found in the compounding of old turbines with new turbines. At first glance it would appear as though this would be impossible without raising the steam pressure, but this is not the case. Two old turbines may be rebuilt to receive steam at lower pressure and temperature than they did before and to thus serve as low-pressure elements to a single new turbine taking steam at boiler pressure. In such cases the extent to which regenerative heating of feed can be obtained will depend upon the design of the casings of the original turbines; naturally, the new turbine can be designed for bleeder nozzles and the



Kilowatt-Hours Generated per Man-Hour

Operating and maintenance labor representative of each year's design practice.

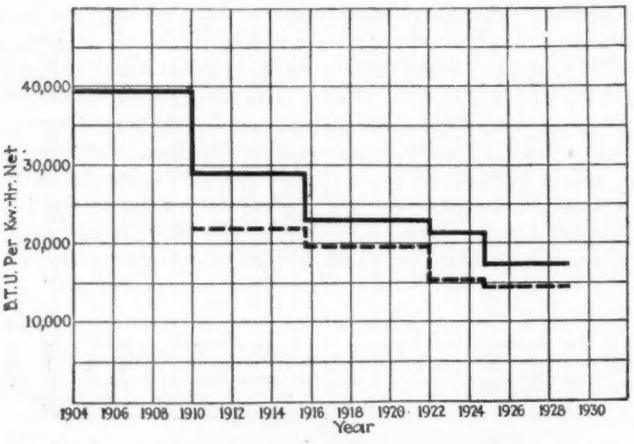
exhaust connection between it and the older units can be tapped for feed heating. This general method can be made to yield an increased generating capacity of at least 50 per cent and a marked improvement of over-all efficiency as well.

Even when neither of the methods just considered is available it is still frequently possible to obtain increased output by the rebuilding of old turbines and generators. No exact values can be given, but increases of the order of 15 to 20 per cent and occasionally even more can be obtained in this way, while at the same time materially improving the over-all thermal performance of the station.

5. Even though it prove commercially undesirable to replace or to rebuild the old turbines, it is still frequently possible to obtain marked thermal improvement in addition to that which can be obtained in the boiler room. This can be done through modification of the auxiliary power supply and the heat balance of the station. One is inclined to think of regenerative feed heating as necessarily tied to the bleeding of each main unit. In fact, it is obtained to a certain extent whenever that steam which is used for heating feed-water has done useful work before being used for that purpose. From the thermal standpoint it is most perfectly obtained when the steam has done the greatest amount of work before being used for heating and when the heating is done in

the greatest number of temperature steps. Practically two or at the most three steps will ordinarily prove economically the best with moderate steam pressures such as one would expect in plants now being rehabilitated.

The fact that comparatively small turbo-generators can now be obtained with steam rates that compare very favorably with those of their larger brothers opens up possibilities of effective regenerative feed heating even



Effect of Additions to Generating Capacity on Economy

Solid line indicates actual conditions while the dotted line shows the thermal economy that would be obtained if the older parts of the system were replaced by modern equipment.

when the main units are not equipped with bleeder nozzles. Thus, a new unit equipped for bleeding very great quantities of steam may be used to supply auxiliary energy and such part of the station output as may be necessary in order to produce the required amount of steam.

The steam bled and exhausted from this unit may then be used for regenerative heating of the condensate from all main units. Thermally, the result would be the same as that attainable through bleeding of the main units if the steam rate of the small unit were the same as that of the larger. Practically, the result will generally not be quite as good because of the higher steam rate of the small unit.

Certain disadvantages flow from this sort of a tie between auxiliary power and main bus, because of the ease with which electrical trouble can cascade. However, protective devices and schemes of connection now available make the arrangement reasonably safe and thus worthy of consideration in cases of rehabilitation.

It is worthy of note that rehabilitation of the sort which greatly increases station capacity will generally result in a radical reduction of investment per unit of capacity. It is not at all uncommon to obtain the increment capacity at from four- to six-tenths of the investment characteristic of the original station. On the other hand, the rebuilt station is generally more crowded than the original and operating facility may have been sacrificed to a certain extent in producing it. The reduction of man-hours per unit of station send-out which should follow the increased capacity may therefore be partly counterbalanced through having to use more men than would be used in a new station of similar unit sizes.

It is true that some executive engineers do not accept rehabilitation as economically justifiable on their own systems. Therefore, it is not legitimate in all cases to predicate original station design on the assumption that rehabilitation will be a necessary part of the history of the plant. However, such rebuilding to a greater or lesser extent appears to be becoming more general than it once was and the history of any given system with respect to such practices should be given serious study when designing new plants for that particular system. If it has been one in which rehabilitation has been found economically desirable it is obviously the part of wisdom to design rather generously with respect to ground area, floor area, cubical contents and clearances, so that if and when rehabilitation becomes necessary there may be the greatest degree of flexibility. It is patent that this consideration should not be used to the disadvantage of the present in order to obtain a questionable advantage in the future. But in the design of any station many decisions must be made on very intangible grounds; the proper values cannot be determined by calculation and the decision must in the end rest upon personal opinion or arbitrary choice. In such cases it is well to consider the effect of such decisions upon the possibilities of future rehabilitation.

These remarks prompt another line of thought. At the time a station is designed certain economic balances must be struck in arriving at a proper compromise between investment and performance. The factors of useful life and expectable use during that life necessarily enter such calculations. In connection with these there is a fact which is frequently overlooked and which it may be profitable to point out. Few stations are built complete at one time; they are generally built in two, three or more steps with the process extending over a period of from five to ten years.

While successive steps may be made to embody certain improvements, the general station design and the consideration of operating facility place some real limitations on this process. It follows that such facts ought properly to be taken into account at the time of station design. Thus, if we assume a useful, high output life of, say, ten years as the basis of design and then build serially so that the last unit is placed, say, five years after initial operation of the first, we may very materially reduce the period assumed as ten years if our other assumptions were correct.

Index Published Separately

THE index of the January to June, 1929, issues of ELECTRICAL WORLD will be published as a separate pamphlet with elaborate cross references. If you bind your copies attach this notice to a sheet of paper, sign it with your name, company position and address and mail it to the Circulation Department, McGraw-Hill Publishing Company, Inc., Tenth Avenue at 36th Street, New York City, and an index will be sent to you.

What Happened at Swampscott

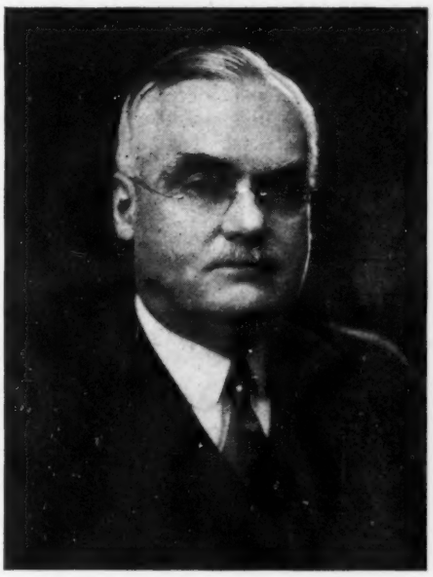
THE summer convention of the American Institute of Electrical Engineers, held at Swampscott, Mass., June 24-28, was replete with interesting technical and entertainment features. Outstanding papers were the symposium on "Synchronized at the Load" and "Rehabilitation and Rebuilding of Steam Power Plants," each of which appears in somewhat reduced length on pages 7 and 13, respectively, in this issue of ELECTRICAL WORLD. Brief abstracts of other papers presented at this meeting, together with outstanding points in the ensuing discussions, are included in this and following pages. For further details see page 1344 of our June 29 issue.

A FEATURE of the session on distribution and power generation on Tuesday morning was a symposium on a new method of system connection as developed by the United Electric Light & Power Company in New York City. The fundamental idea is to put all loads and all generators on a distribution network or grid, thereby eliminating generating station and substation busbars and having all generators synchronized at the load grid.

The system eliminates energy concentrations in generating and substations and represents the ultimate in decentralized power supply. It has been tested out and works splendidly. The symposium on the subject was made up of "The Fundamental Plan," by A. H. Kehoe; "Calculations of System Performance," by S. B. Griscom, and "System Tests and Operating Connections," by H. R. Searing and G. R. Milne. These papers are abstracted elsewhere in this issue.

Another notable paper at this session was the "Rehabilitation of Power Plants," by C. F. Hirshfeld. The author showed developments in practice toward higher pressures and temperatures and discussed fully the things that should be considered in attempts to rehabilitate older stations. The balance between cost and thermal and operating efficiency gains is very delicate and an analysis must be made of each case. Such an analysis, however, will show that a modernized plant will pay dividends in many instances.

Distribution problems are encountered in all metropolitan centers and Boston has adopted the use of many small automatic transformer substations as the basis of its distribution. These stations were discussed in a paper by W. W. Edson. The stations are made up of units ranging from 5,000 to 15,000 kva. ultimate capacity and are equipped with specially designed transformers and automatic control equipment. The transformers have an inherent 50 per cent overload capacity and have load-current relays for switching in or out the transformer as needed.



Prof. H. B. Smith
President-Elect A.I.E.E.

The final paper on the program was the "Application of Induction Regulators to Distribution Networks," by E. R. Wolfert and T. J. Brosnan.

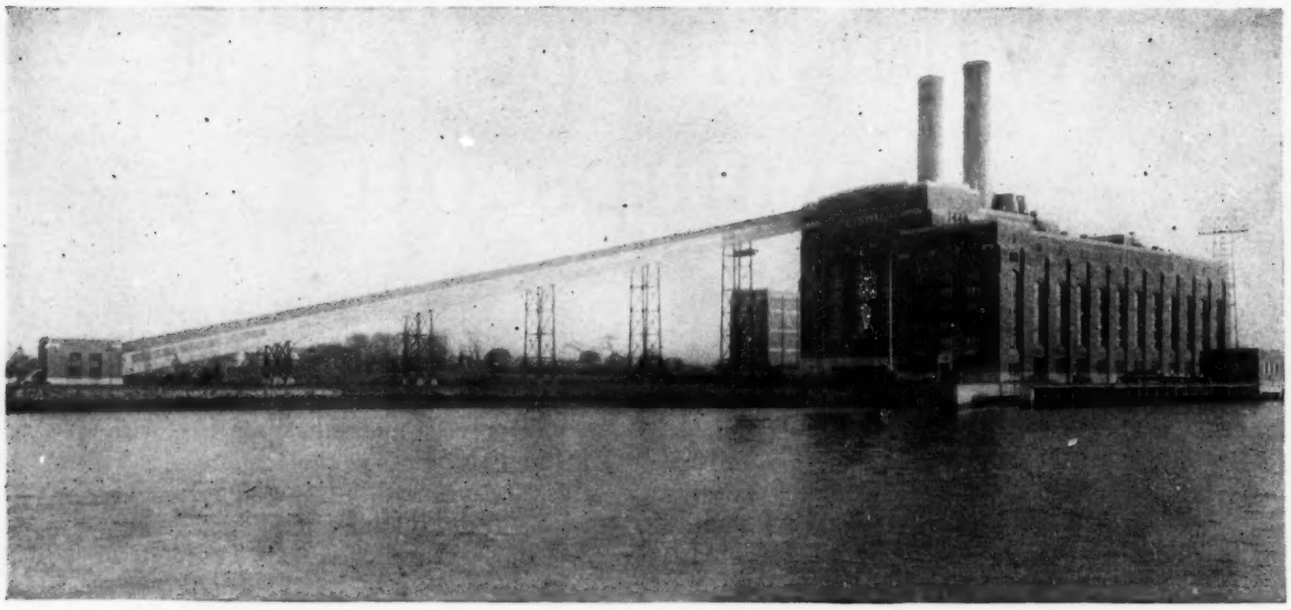
About 80 per cent of the network systems employ induction regulators to control the voltage of the network. More than 75 per cent of these apply regulators to individual feeders. On a three-phase, three-wire feeder one three-phase regulator, two single-phase regulators or three single-phase regulators may be used, while on a three-phase, four-wire feeder either three single-phase or one three-phase regulator may be used. Any of these give satisfactory operation when the line currents are balanced. The use of 11 kv. and 13.2 kv. for alternating-current automatic network systems has become common and either high-voltage regulators or low-voltage regulators with transformers can be applied to the system.

In the parallel operation of regulators mechanical interconnection has been found best. But this cannot always be done and some form of electrical interconnection is necessary. The principle of cross-compensation is applied to get this result to feeders with appreciable impedances. Several other connections have been devised to meet particular conditions.

Discussion of C. F. Hirshfeld's paper on rehabilitation involved citations of specific experiences of two companies in rebuilding power plants and emphasis on the necessity of considering each case as a separate problem. Several speakers pointed out that Mr. Hirshfeld had given engineers a lot to think about, but warned that no general rules can be applied.

E. S. Fields, Cincinnati, told how the Columbia Gas & Electric Corporation increased the capacity of two of its stations 105,000 kw. without major rebuilding and at considerably less than the unit cost of building a new station. Among methods used to provide this additional capacity were: Minor rebuilding of turbines to drive larger generators by adapting diaphragms to larger steam flow, increase of steam pressure and steam temperature; installation of extraction heaters; substitution of motor-driven auxiliaries for steam; new oil circuit breakers and disconnects; stronger bus insulators; installing new high-pressure turbines compounded with turbines removed from another plant; replacement of refractory boiler walls with water-cooled linings; new baffling; powdered coal feed; new runners on induced-draft fans and water pumps, and converting to two-pass condensers.

W. S. Lee, Charlotte, N. C., commented on the service and financial angles of rehabilitation. In this day of mergers, companies must be prepared to do away with small units, he said. On



Charles Leavitt Edgar Station, Weymouth, Mass.

the Duke Power system, where load has increased 9 to 11 per cent yearly, the newer steam stations are being built as base-load stations and the old stations are retained for reserve capacity. But even these have to be wiped out in twelve to eighteen years after date of building. At one time steam stations were placed at loads. Now base-load plants are being placed at geographic load centers to save transmission costs. Mr. Lee warned against higher pressures without careful study of economy.

W. J. Foster, Schenectady, declared that it is much easier to produce benefits by rehabilitating old waterwheel units than steam units, because recent developments permit rebuilding armatures for greater output. He advocated replacing rather than rebuilding old steam turbines because they have a lower speed than is now justified. A conservative rating is more important than the maximum output per pound of material, he contended.

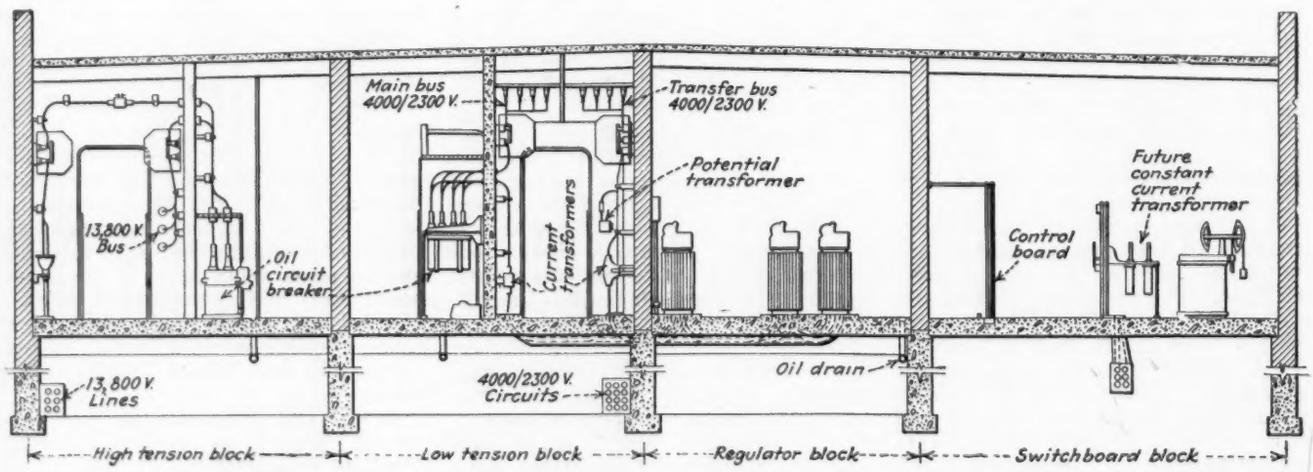
L. W. W. Morrow, ELECTRICAL WORLD, emphasized the fact that the investment per unit of output is increasing, whereas the income per unit is decreasing and capital turnover is slower. Therefore it is imperative to avoid being squeezed by these two wedges either by holding down the unit investment or increasing the use of facilities. He referred to power as a by-product and using other than a water-cycle in power generation as needing continued engineering study.

The symposium on "Synchronized at Load" evoked discussion chiefly on the experiences obtained with this system. G. R. Milne declared that 70 faults on the New York system had caused voltage dips up to 33 per cent, but the fluctuations averaged only 2½ per cent. Disturbances at the load were reduced 50 per cent. With a fault on a 13.2-kv. feeder close to Sherman Creek station the generators were deflected only 8 deg. from normal position. A phase-neutral fault at Hell Gate June 21 with 300,000 kw. in generator operating cleared in 10½ seconds with only 2½ deg. deflection of the generators.

E. E. Chilberg, General Electric Company, declared that when double-circuit generators are used with the "synchronized-at-load" network they can ride through most any bus fault.

R. H. Tapscott, New York Edison Company, warned that all systems are not adaptable to the "synchronized-at-load" scheme. He agreed that a combination of double-circuit generators with "synchronized-at-load" networks will greatly increase reliability of service and reduce the size of spare units necessary. The combination will at the same time avoid the need of reactors and permit using smaller oil circuit breakers.

E. A. Hester, Duquesne Light Company, said that the "synchronized-at-load" idea does not appear favorable to Pittsburgh conditions. The greatest advantages accrue from having a high impedance between generators, but not over the part of the circuit carrying the largest loads. To reap these advantages there must be a large number of feeders per generating unit.



Cross-Section of Humboldt Avenue Substation (Edson)

Railroad Electrification Topics

AT ONE of the sessions on Tuesday morning important developments in railroad electrification were treated. An interesting paper by J. B. Cox described the electrification of a 29-mile mountain division of the railway between Mexico City and Vera Cruz. Power is purchased from a local utility at 42,000 volts, 60 cycles and transformed by 1,500 and 3,000-kw. synchronous motor-generator sets to 3,000 volts d.c. for supply to a single catenary trolley system. The locomotives are of the twin-geared, six-motor, articulated-truck type, capable of 40 m.p.h., and are provided with regenerative braking. The installation has been very successful and profitable and the author included splendid economic data.

An interesting study of contact wire wear was presented by I. I. Landhy. No very tangible results were found, but in general wear is minimized by having a flexible contact wire with little concentrated weight, gradual transitions from one height to another and a light and free moving pantograph with sufficient contact pressure. Lubrication is a debatable proposition in general and the speed of train and amount of current collected do not affect the wear appreciably.

One of the new substations for the Pennsylvania electrification was described by J. V. B. Duer. It accommodates two single-phase, 132-kv. transmission circuits, allowing sectionalization of each of these circuits, by air-break, motor-operated disconnecting switches. The tap from each of these circuits passes through similar disconnects to the 132 to 12-kv. transformers, the tap having choke coils and arresters. The low-voltage side is carried through oil breakers to a section of the 12-kv. trolley bus. Each bus section has a trolley and a rail bus.

The 1,500-volt direct-current substations for the Illinois Central electrification in Chicago were described by A. M. Garrett. This installation has been described previously and the author gave reasons for the selection of the two types of conversion units and reported on the operation of the system.

Discussing Mr. Cox's paper, Professor D. C. Jackson commended the detailed cost comparison included in it and expressed the hope that a year's data would soon be forthcoming. He also spoke highly of the promising future before the mercury-arc rectifier. Sidney Withington pointed out the importance of comparing the most modern steam locomotives with electrical equipment in present-day estimates of electrification economics and stressed the necessity of providing for maximum service continuity in the design of overhead feeder and contact systems, referring to Mr. Duer's paper. W. B. Potter brought out the opportunities for the use of mercury-arc rectifiers in cases of industrial power supply where current reversal would be disastrous. Mr. Garrett stated in closing that much remains to be learned about rectifiers, although experience has been promising thus far.

Technical Committee Reports

IN TWO parallel sessions on Wednesday the chairmen of the technical committees of the Institute reported on their activities and development in their respective fields of endeavor. These reports cover much material of great value and it is possible only to highlight a few of the more important topics and trends.

Research: F. W. Peek, chairman.—Important researches under way in the industry cover electrical insulation, electric arcs, reflection of atoms on crystals, excitation of atoms by electron impact, corona voltmeter, redetermination of value of international ohm, radio beacons for aircraft, electrical seismometer, high-voltage flashovers, lightning waves, television, magnetic materials and many other types. Important progress has been made on researches and a great deal has been done to co-ordinate the work of the several agencies.

Electrical Machinery: W. J. Foster, chairman.— An important part of the work has dealt with standards. The proposed rating standards of the I.E.C. have been discussed, but have not been agreed upon because of fundamental differences. The transformer standards have been modified to give operation based on temperature. Standards for constant current transformers are about complete and work is being done for rules and standards covering low-speed prime movers, alternating-current commutating motors, mercury-arc rectifiers and losses in machinery. An important project is to develop uniform test codes for the industry. In machine developments there has been little startling or unusual. Improved efficiencies are had, inclosed ventilation is favored, gas cooling is being used and welded or fabricated construction predominates.

Electrochemistry and Electrometallurgy: G. W. Vinal, chairman.—Electricity has come to play a very important part in chemical and metallurgical industries. The chromium plating industry is a new and rapidly developing business, electroplating of other metals is being developed, hydrogen for industrial use offers big possibilities, electrolytic copper and zinc are big business enterprises, nickel and aluminum are largely the result of electrical production methods. Market changes have made purity imperative and electricity is the means to that end. Many researches are under way for new applications and the committee is enthusiastic over future developments.

Protective Devices: E. A. Hester, chairman.—This committee is largely concerned with arresters, reactors, relays, oil breakers, fuses and general industrial protective apparatus. Standards for arresters are under way, research on lightning is proceeding rapidly, transformer failures are being investigated, study is had of the use of fuses on high-voltage lines.

In the relay art developments are quite rapid toward new systems rather than new devices. These systems use the principle of the pilot wire or balance, but tend toward radio and superimposed frequency devices. The isolation of troubled portions of a system is of paramount importance and new ideas are needed.

Iron and Steel Production: N. M. Fowler, chairman.—The steel industry is completely electrified for power drive purposes. Of the 1928 purchases of motors about 80 per cent were direct current, showing the essential speed control that governs selection. Ward-Leonard controls have been placed in blast furnace skip hoists, individual drives for continuous steel mills are on the increase, a new mill type motor has been developed and standardized and fabrication has replaced castings in large measure. An electrically operated

Large Steam and Hydro Units Installed (Allner)

Purchaser	Kva.	Speed	Voltage	Shaft	Manufacturer
State Line Generating Co.	235,000	1800	22,000	3	G. E.
United Elec. Lt. & Pr. Co.	188,400	1800	13,800	2	West.
United Elec. Lt. & Pr. Co.	188,250	LP 1200 / HP. 1800	13,800	2	A. B. B
American Gas & Elec. Co.	187,000	1800	11,000	3	G. E.
N. Y. Edison Co.	160,000	1500	11,400	1	G. E.
Brooklyn Edison Co.	137,500	1800	13,800	2	West.
Southern Calif. Edison Co.	100,000	1500	16,500	1	G. E.
Union El. Lt. & Pr. Co.	83,333	1800	13,800	1	G. E.

Purchaser	No.	Kva.	Speed	Manufacturer
Dnieprostroy Hydro-electric dev.	4	77,500	88.2	G. E.
Lexington Power Co.	4	40,625	138	West.
Philadelphia Elect. Co.	4	40,000	81.8	G. E.
	3	40,000	81.8	West.
New England Power Co.	4	39,000	138	West.
Braxilian Hydro-electric	1	33,000	125	G. E.
Southern Calif. Edison	1	35,000	375/450	G. E.
Alabama Power Co.	2	29,000	100	West.
Norwood Electric Co.	2	27,500	90	A. C.
City of Los Angeles	1	25,000 (Hor)	143	A. C.
Montana Power Co.	2	25,000	81.8	West.
Norwood Electric Co.	1	22,500	75	A. C.

mud gun is a very important development for blast furnace use.

Electric Welding: A. M. Candy, chairman.—Welding is now an accepted production practice in many manufacturing lines, but the construction industry has been slow to adopt it. The committee collected data on welded buildings that showed much progress. It outlined the many research problems under way and is helping to develop many codes and standards for this new industry.

Instruments and Measurements: Everett S. Lee, chairman.—One of the important tasks of this committee has been to revise existing electrical units in co-operation with other agencies and to help set up an international body to continue the work. Other important projects were measurement of core loss in terms of sine wave core losses, definition and method of measurement of distortion factor, temperature measurement, metering large blocks of energy, dialectric loss and power-factor measurements, high-freqency metering, remote metering and studies in shielding. Advances during the year were made in frequency measurement and control and in the art of cathode-ray oscillography.

Electrophysics: V. Karapetoff, chairman.—A splendid attempt is made to tie pure physics to technical electrical engineering by this committee. Basic study of electricity must be made in terms of matter, space, time, velocity, and the revolutionary experimentation and theoretical changes in pure physics made recently call for a complete stock taking of fundamental physical conceptions. Scientists are groping as never before and cannot grasp a tangible research. The bearing of these things on dielectric studies, ferromagnetism, wave propagation in space and radiation are evident. At present we are at a standstill both on fundamental observations and on fundamental theories and need a genius to lead us to light.

Transportation: W. M. Vandersluis, chairman.—This has been an active year in railroad electrification. Projects completed or under way include the Pennsylvania Railroad, the Great Northern, Boston, Revere Beach & Lynn Railroad, Cleveland Union Terminal Company, Reading Company, Delaware, Lackawanna & Western Railroad and the city of Rochester. Particularly marked is the growth of electrified terminals for large cities. In the general field of transportation improvements have been made in train control, high-speed breakers, supervisory control and in oil and gas-electric locomotives.

Education: Edward Bennett, chairman.—This committee has felt the need of some method to continue the education of engineers after they graduate and while employed. Some systematic method must be devised and plans are under way to work with local sections to develop a program of post-college education.

Application to Mining Work: Carl Lee, chairman.—The necessity to reduce operating costs has made mine owners accept modern electrical equipment readily during the past year or two. Much progress has resulted in hoists, locomotives, automatic substations, mine cables and other equipment. Especially notable is the development of very large electric shovels, car unloaders and loading machines. Accessory devices, such as telephone systems, safety devices and automatic power supply equipment, have had corresponding development and acceptance. It may be said the mining industry is modernizing very rapidly by the use of electrical applications.

Automatic Stations: W. H. Millan, chairman.—During recent years the use of automatic generating stations and substations has grown rapidly. They reduce labor charges and improve the reliability of service, as a general rule. Despite a large amount of development, the installations have been very successful and the automatic station is an accepted and very useful installation for many properties. Recent developments have dealt with ventilation, noise, switching, relays, supervisory signals and controls and other accessories that make the station better and more reliable. The stage has been reached where much work is under way to produce standards. Some are already available and others are in process.

Transmission and Distribution: H. W. Woodrow, chairman.—This large and active committee has dealt with several major activities during the year. These may be listed as: Lightning and surge problems, insulator design, pole and tower design, cable development, system stability, standardization and research. The lightning problem is thought to be well in hand and a general improvement program is on for cables. Attempts to standardize insulators and air switches are difficult, however, in view of the absence of complete lightning data. The general problem of system stability is about solved, but many finite-limiting factors must be determined. Organized research and analytical work are under way by subcommittees on these and other problems.

General Power Applications: J. F. Gaskill, chairman.—A gradual electrification process is occurring in all industry. This committee reviewed developments and pointed out new and large equipments used in marine work, in the paper industry, in steel mills, in material handling, in the cement industry, in mining and in miscellaneous groups. Significant trends deal with control applications, the use of special process machinery and the greater use of electric heat and electric welding.

Production and Application of Light: B. E. Shackelford, chairman.—In lamp manufacture the program of simplification and standardization has been carried toward completion. The development in neon lamps consisted in the use of smaller electrodes and higher current densities, together with new color effects, by the use of improved filter glasses. The electrodeless discharge in neon has been used as an airway beacon lamp.

During the year the application of light along modernistic lines has proceeded rapidly. Also, many lighting systems with 20- to 30-foot-candle intensities were installed and in some instances 40- to 60-foot-candle intensities over large areas have been found economical. In home lighting many modernistic fixtures have been placed on the market. In the theater a great advance has been made in the application of colorful lighting effects and about 60 per cent of the motion pictures are now made with incandescent lamps. Standardization of traffic signal lighting has gone on and a new development is a portable traffic flashlight.

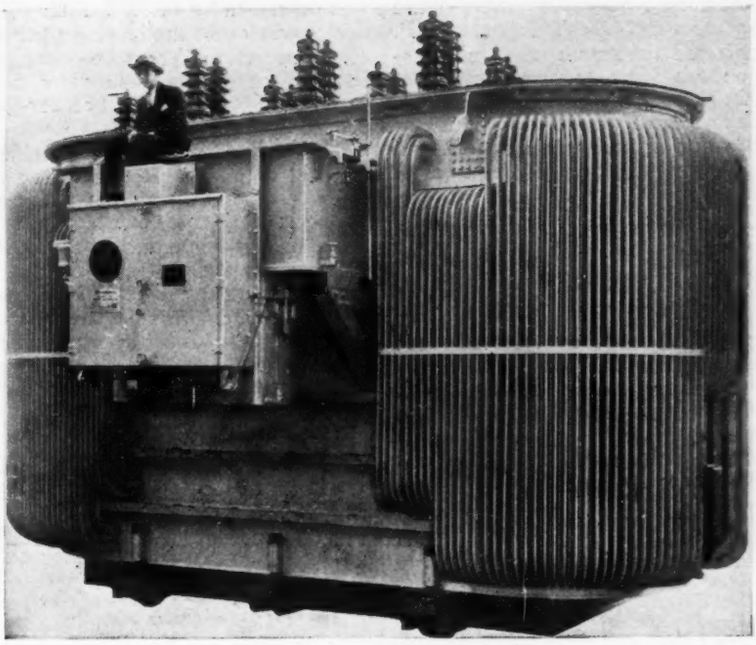
In sign, flood and architectural lighting great advances have been made and aviation lighting has become very satisfactory. In all lines the committee reports steady progress in the technical and application aspects of lighting.

Power Generation: F. A. Allner, chairman.—Major studies of this committee dealt with excitation systems, interconnection, rehabilitation of plants and hazards to service reliability in modern stations. The committee points out the trend of station design as influenced by load growth to be toward larger units and higher efficiencies. For hydro stations it states the equipment cost is only 10 to 15 per cent of total station cost as compared to 50 to 55 per cent for fuel-burning stations. Thus the 92 to 94 per cent peak efficiencies of hydro plants compare very favorably indeed with the 23 to 27 per cent overall efficiency of steam stations. The committee reviews salient trends in hydro and steam station development and cites examples.

Electrical Communication: H. W. Drake, chairman.—In telephone com-

Arrangement of Heating Surfaces in Typical High-Pressure Boilers (Allner)

Type of Boiler	Edgar, Boston, Cross-Drum Straight Tube	Holland, Cross-Drum Straight Tube	Northeast, Kansas City, Multidrum Bent Tube	Lakeside, Milwaukee, Multidrum Bent Tube
Total convection surface sq.ft.	58,302	66,066	69,761	68,852
Boiler surface—per cent conv. surf.	12.0	12.0	24.3	41.4
Superheater surface—per cent conv. surf.	8.7	6.9	3.8	....
Gas reheater surface—per cent conv. surf.	11.9	17.2	....	....
Economizer surface—per cent conv. surf.	16.5	17.6	15.6	....
Air heater surface—per cent conv. surf.	50.9	46.3	56.3	58.6
	100.0	100.0	100.0	100.0
Water wall surface—per cent conv. surf.	2.1	....	4.4	2.2
Radiant superheater—conv. surf.	....	....	....	2.7
Radiant reheater—conv. surf.	....	....	0.7	1.4
Steam reheater—conv. surf.	....	2.2	....	....



Load-Ratio Control on 120-Kv./20,833-Kva. Transformer
(Electric machinery committee)

munication the development of a transmission reference system and the adoption of the "bel" as the fundamental unit of transmission are two outstanding developments. Improvements in equipment have occurred, dial systems have been extended and extensive applications have been made of short-haul single-channel carrier systems. An electrical alarm system has been developed to indicate moisture in cables. The insulating properties of textile insulation have been thoroughly investigated and the use of cellulose acetate has been extended greatly.

Other developments have concerned themselves with airways communication, wire line systems for broadcasting, frequency control in radio, railroad train radio, transatlantic telephony and telegraphy, printing telegraphy, television, sound pictures, facsimile transmission and municipal and protective signaling.

Nine committee reports, which might be classified as the industrial group, were discussed jointly. W. J. Foster said that hydrogen cooling has its greatest advantage with generators, although it has been applied chiefly to synchronous condensers. C. J. Fechheimer explained how a double entry fan had been used to get 55 per cent efficiency where space between shaft and ordinary fan peripheries would have otherwise caused high velocities and big losses. E. Fleischmann, Niagara Falls Power Company, called attention to the rapidly extending use of resistor type furnace for nitriting of steel as contrasted with cyaniding. J. C. Lincoln, Lincoln Electric Company, referred to a nickel-plating method which secures extra-firm adherence of the nickel by immersing the metal to be plated in strong sulphuric acid and passing a small current prior to plating. He also illustrated a number of cases where electric-welded structures had replaced castings at considerable saving in total cost and reduction in weight.

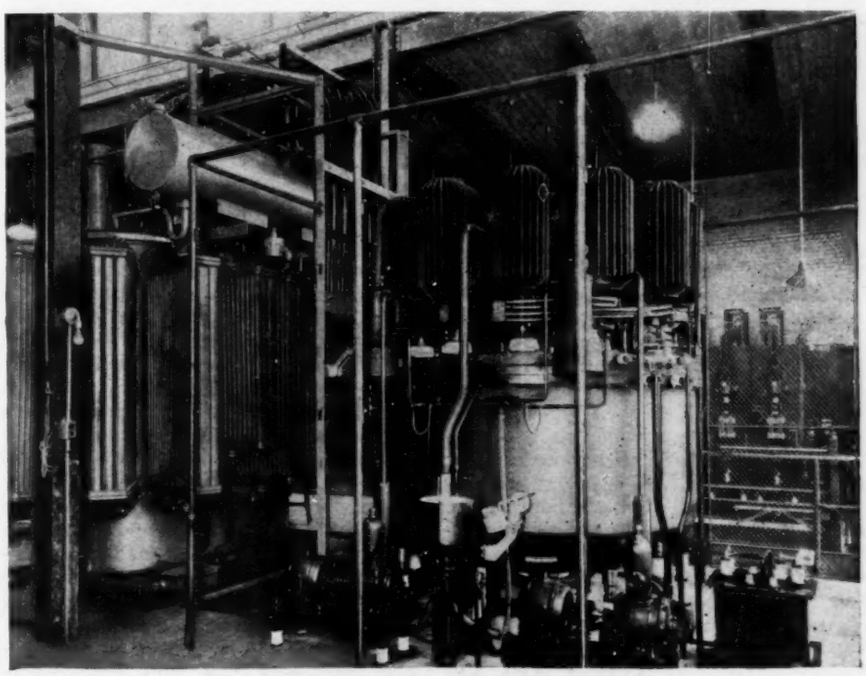
Professor E. C. Caldwell declared that streets could be made more attractive at night by using asymmetric refractors on the street lamps to direct light across the street on the building fronts.

The remaining nine committee reports were discussed as a group. Professor Caldwell in discussing the report of the committee on education suggested the need for providing training less rigorous theoretically for the majority of undergraduate engineers. Chester Lichtenberger, Philadelphia, declared that too little attention is given to training for mechanical design in electrical engineering courses.

Following the presentation of Chairman Lee's committee report on instruments and measurements, F. A. Wolff of the Bureau of Standards predicted that ultimately working standards and absolute measurements will come closer. He favored the establishment of working standards in cells and in resistance material even though absolute measurements may indicate a slight error in such physical entities. Agreement to one part in 100,000 after seventeen years' use exists in cell standardization carried out by the bureau.

Messrs. Allner and Woodrow's reports were discussed together. W. Gay Newark, N. J., described a scheme of auto-transformers at each end of a generating plant-substation double-tie line designed to prevent the formation of power arcs in case of lightning troubles at insulators. P. B. Juhnke maintained that by utilizing old capacity in generating plants, peak loads can be carried most economically, and that the construction of new plants for peak service, *per se*, is of doubtful value. W. A. Del Mar of the Habirshaw company questioned the quality of accelerated life tests on cable as at present laid out. D. W. Roper, Chicago, said that in view of the perfect two-years' record of 54 miles of 132-kv. oil-filled cable in Chicago and New York plans are being made for 220-kv. cable to bring bulk power into Chicago, thus eliminating the construction of certain substations in the outskirts of the city. Nearly all of the speakers stressed the great importance of system planning in relation to the heavy loads anticipated during the next five years.

Commenting on the report of the committee on automatic stations, C.



3,000-Hp. Mercury-Arc Rectifier in Chicago
(Electric machinery report)

Lichtenberger intimated that there are attractive possibilities in capital saving in plant design by doing away with switchboard rooms and galleries. This involves putting various switching units around the walls, but in many cases this is not objectionable. He urged the standardization of lamp and system voltages employed in telemetering and stated that automatic stations are now in use in every country except China. H. B. Sleeper cited the value of trouble reports on the New Jersey system and said that these have been helpful in the purchase of new equipment, in directing concentration of maintenance work and in pointing out weak points in design of apparatus types to manufacturers.

Miscellaneous Developments

ON WEDNESDAY afternoon several miscellaneous papers were presented. Edwin Fleischmann presented a fundamental paper on the design of electrical heating elements. While the classical theory of design is well developed, there has been little of it applied to practice because of its complexity and the number of variables to be evaluated. In dealing with metallic resistors for high temperature work Mr. Fleischmann develops the fundamental equations of Ohm and Stefan-Boltzman to connect electricity and heat together.

But the heat developed has its counterpart in the heat leaving the resistor and the author then develops expressions for heat radiation and conduction. He then compares the empirical expressions commonly used and shows that some of them, at least, give conservative ratings.

Another interesting paper by C. B. Coates dealt with 180-cycle induction motors applied to portable tools and equipment. The characteristics of motors of this kind are described and the applications are discussed in terms of the performance desired. These high-speed tools are in use in quantity and several unusual design problems are encountered in developing a motor to meet the requirements.

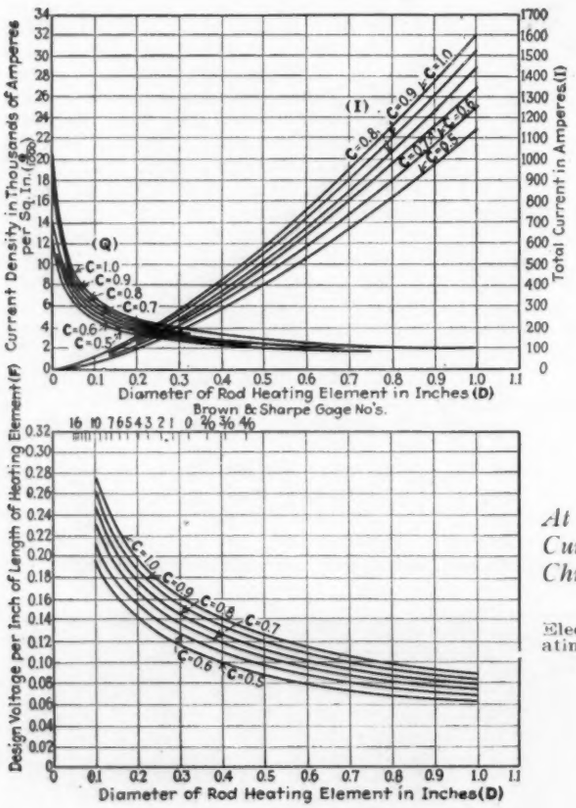
A problem encountered by many engineers involves the analysis of waves on power and telephone systems. R. G. McCurdy and P. W. Blye described two types of electrical analyzers developed for the direct measurement of voltage and current components—the power circuit analyzer uses multi-stage vacuum tubes and two selective circuits to measure voltages in the frequency range from 75 to 3,000 cycles and over a voltage range from 0.5 millivolt to 50 volts; the telephone analyzer operates over the same frequency range and measures harmonic currents as low as 0.05 microampere and voltages as small as 0.005 millivolt. The characteristics of both instruments are described and discussed.

Many attempts have been made to devise equipment that will synchronize generators automatically. The latest design that has been tried out in practice was described by F. H. Gulliksen. This device will cause the closing mechanism of a circuit breaker to be energized in advance of synchronizing by a time determined by the breaker-closing operations.

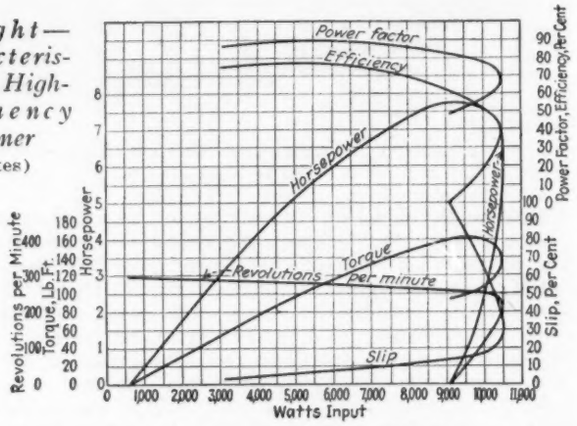
The frequency of the machine is matched by separate speed-matching equipment. Two models have been developed and applied, one being designed for very erratic frequency applications. The synchronizer consists essentially of two independent coil-core lever systems and four direct-current relays of the telephone type. It cares for equality of voltage and required phase relations and may be adjusted readily for a wide range of application.

An interesting paper on a master reference system for telephone transmission was presented by W. H. Martin and C. H. G. Gray. The system was devised for the expression of transmission standards and the ratings of the transmission performance of telephone circuits. The transmitter and receiver elements of the system are references for the ratings of transmission and performance of terminal station sets.

The transmission performance is treated as a physical action and as the relation between this action and intelligibility. In the last part of the problem the variable human element is introduced to make a difficult problem. The master reference system employs a transmitter and receiver almost free from distortion and a line made of resistors. The specification of performance is based on the principle of the thermophone or acoustic pressure measurements.

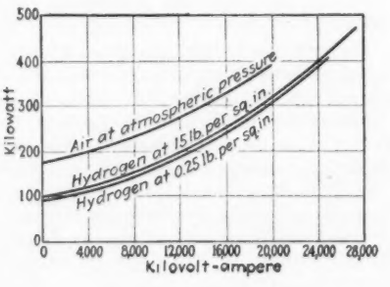


At Left — Design Curves for Nickel-Chromium Heating Elements
Electric furnaces operating at 1,850 deg. F.
(Fleischmann)



At Right — Characteristics of High-Frequency Reamer
(Coates)

Below — Total Losses of the 20,000-Kva. Hydrogen-Ventilated Synchronous Condenser
(Wieseman)



Commenting on the Martin-Gray paper, Dr. F. A. Wolff, Bureau of Standards, said that the master reference system described is particularly valuable because it affords reproducible conditions for comparison and because it is so free of distortion. J. J. Smith, Schenectady, reported that the General Electric Company has used the wave analyzer described by R. G. McCurdy and P. W. Blye to study harmonics produced by motors and generators with excellent results, but he warned that auxiliary measuring apparatus may produce harmonics which will confuse results unless guarded against. J. O. Coleman, N.E.L.A., also reported use of this analyzer during the last four or five years in joint studies with telephone interests. Its shielding permits use in proximity to heavy feeders.

The subject of high-frequency tools aroused considerable discussion. A. M. MacCutcheon, Reliance Electric & Engineering Company, referred to what he called a rotating transformer as a possible means of obtaining high frequencies for such tools. F. L. Snyder, Westinghouse company, said that the induction frequency changer has an advantage over a motor-generator because the motor does not have to have as large a rating as the generator. The low power factor will not be detrimental, he contends, because the high-frequency tool load usually represents a small portion of the total. If it is objectionable capacitors can be used.

Two hundred and twenty-volt or even 440-volt distribution with transformers near the tools was recommended to minimize the voltage drop at 180 cycles. B. B. Ramey, Black & Decker Manufacturing Company, pointed out that high-frequency tools speed production because of their maintenance of speed at all loads and, besides, the ventilation is better. He does not believe that the losses at 180 cycles are sufficient to make 110 volts objectionable. C. B. Coates reported that it is customary to install induction frequency changers near the tools to save cost of wiring. The diversity factor is very high.

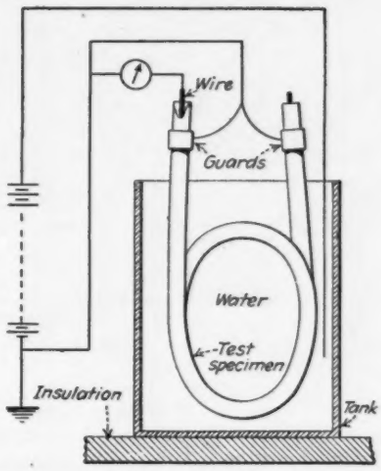


Diagram to Show Method of Using Guards in the Measurement of the Insulation Resistance of a Wire or Cable

(Curtis)

Shielding in Measurements

UNDER the auspices of the instruments and measurements committee a symposium was held on shielding in electrical measurements. This occurred on Friday morning and created much favorable comment. In a paper dealing with the general principles of shielding Harvey L. Curtis pointed out that protection is needed from leakage currents, electrostatic fields, magnetic fields and electromagnetic waves. Remedies for some of these influences are not effective against others, so that precision measurement becomes complicated in technique and in apparatus. Metallic and magnetic cases, good insulators and eddy-current catchers were some of the methods discussed. In measurements with large alternating currents F. B. Silsbee discussed the shielding problem. In power stations some of the remedies to apply are (1) to arrange cables for minimum magnetic effects; (2) to use shielded or astatic type instruments; (3) to repeat readings with connections reversed; (4) to avoid all loops in connecting leads. The several effects were discussed and the value of stray fields were indicated. In measuring dielectric loss of short lengths of power cable problems are introduced that were discussed by E. H. Salter. The losses resulted on short and long lengths of cable vary greatly and the author explains the discrepancies as being due largely to end loss effects. Schemes for guarding test specimens were given, including preparation of the cable ends. Several types of cables and cable ends were discussed and it was found that single-conductor cable is best guarded by isolating about 12 in. of the specimen at each end. For belted type cable corona effects are removed by cutting off the belt insulation even with the sheath end and placing guards in the crotch. The simplest method of preventing crotch losses in shielded three-conductor cable is to have the metal foil on the individual conductors beyond the crotch space a matter of 4 to 6 in.

Problems in dielectric loss measurements were discussed in a paper by C. L. Dawes, P. L. Hoover and H. H. Reichard, the bridge method of measurement being described in detail with respect to shielding precautions. The condenser instruments, transformers and other apparatus were discussed to show errors that may be introduced and methods to eliminate them. Some of the conclusions reached on this subject were as follows:

1. The bridge must be shielded from magnetic, electrical and mechanical disturbances.

2. The air condenser and bridge leads should be shielded at the same potential as that of the shielded conductors.

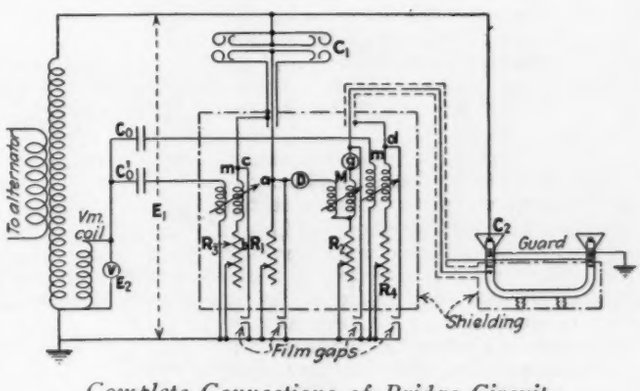
3. The cables should be shielded and brought to the same potential.

4. The bridge can be used to measure the ratios and phase angles of transformers.

Shielding for high-frequency measurements introduces many problems. This subject was presented by J. G. Ferguson. Electromagnetic and electrostatic couplings are introduced by the stray admittances, either direct or to ground, and by the mutual impedances resulting from stray magnetic fields. Two types of shielding have been developed, known as electrostatic and electromagnetic. In the electromagnetic

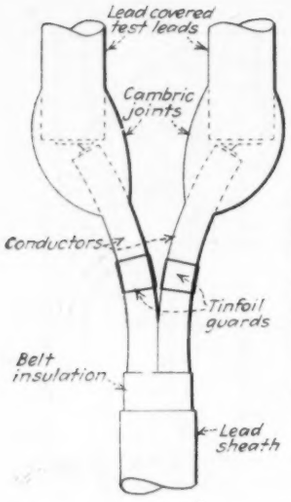
Effects of Stray Magnetic Fields (Silsbee)

Arrangement	Formula	Stray Field $D=50$	$D=100$	$D=200$	$D=500$
Single conductor, return at great distance	$\frac{0.2\,I}{D}$	40	20	10	4
Return at distance g..	$\frac{0.2\,I\,g}{D^2}$	8	2	0.5	0.08
Return in two wires on opposite sides.....	$\frac{0.2\,I\,g^2}{D^3}$	1.6	0.2	0.025	0.0006
Return in four wires at corners of square....	$\frac{0.2\,I\,g^4}{D^5}$	0.064	0.002	0.000625	0.00000064
Return in coaxial cylinder.....	.....	0	0	0	0
Three - phase circuit conductors in a plane	$\frac{2\sqrt{3}\,g\,I}{10\,D^2}$	13.8	3.5	0.87	0.138
Three - phase circuit conductors in a triangle.....	$\frac{\sqrt{3}\,g\,I}{10\,D^2}$	6.9	1.73	0.43	0.069

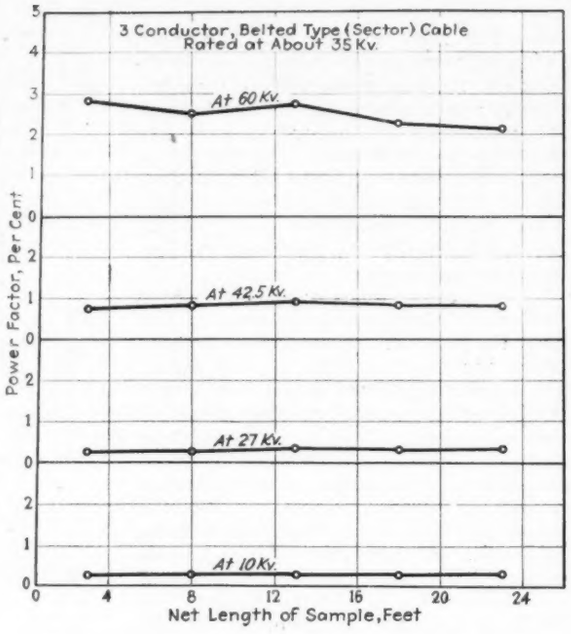


Complete Connections of Bridge Circuit

(Dawes,, Hoover and Reichard)



Method for Testing Crotch Losses
(Salter)


3 Conductor, Belted Type (Sector) Cable Rated at About 35 Kv.
At 60 Kv.
At 42.5 Kv.
At 27 Kv.
At 10 Kv.
Power Factor, Per Cent
Net Length of Sample, Feet

Variation of Measured Three-Phase Power Factor with Net Length of Sample
(Salter)

type unit shielding is practised, but in electrostatic shielding the chief object is to control the couplings since they can't be eliminated. Coils and transformers may be shielded magnetically by the use of high-permeability short circuits or by the use of eddy-current shields in the case of air core coils. The development of electrostatic shielding methods takes up most of the paper, since this is a difficult problem. In general, it resolves itself into a determination of the most advantageous location of the admittances which are arranged to terminate at certain points. No general rule is given, but specific examples are afforded to clarify the application of the principles.

Another paper, by S. L. Gokhale, dealt with the problems involved in the shielding of magnetic instruments from the effects of stray fields. The author discusses zonal harmonic analysis as a preliminary to the development of general shielding equations. He then compares results with experimental findings and shows that the problem of magnetic shielding can be dealt with in precision values.

In discussing Mr. Salter's paper, E. W. Davis said that the experience of the Simplex Wire & Cable Company corroborated the author. It was also brought out that the direct grounding of the guard circuit is the chief cause of error in bridge operations, and that the effect of shielding on power factor in cable measurements is relatively small.

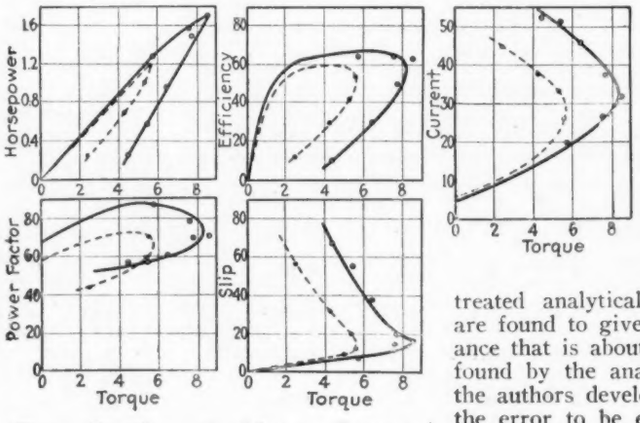
D. W. Roper, Chicago, said that the Commonwealth Edison Company is undertaking extensive tests of sections of 66-kv., 750,000-circ.mil cables in series and of different makes, measuring power factors, ionization factors, etc., through a wide range of heating and cooling cycles. It appears that steps must be taken to compensate for the voltages induced in the cable sheath to avoid measurement errors.

H. W. Lamson, General Radio Company, commenting upon Mr. Hoover's paper, announced the development of a tuned type of transformer (for use in amplifying cardiograph records) resonant at low frequencies of 30 to 40 cycles and opaque to frequencies of 60 cycles and over. He felt that this device might be useful in dielectric measurement technique. Hans Lippelt, referring to Mr. Gokhale's paper, pointed out that laminated shields with copper spacers are more effective than iron shields alone. Dr. W. B. Kouwenhoven stressed the importance of more scientific definitions in connection with shielding and guarding work. He described an air condenser principle and set-up designed to provide an equipment of high accuracy over a range of relative humidities up to 90 per cent, the main plate being both sectionalized and shielded. C. T. Weller said that the greatest gain from shielding occurs in dealing with high voltages, currents and frequencies. He concluded that resistors are to be preferred to reactances or capacitances in tests to determine the accuracy of instrument transformers. D. C. Peterson showed how the error due to charging current can be eliminated by varying the circulation in a water-cooled coil in the Ryan dielectric loss test.

I. M. Stein, Leeds & Northrup, Philadelphia, said that shielding saves space and time, also simplifying technique in standardization. He recommended provision for shielding measuring equipment for transportation between laboratories.

Machinery Progress

ON FRIDAY morning five splendid papers were presented under the auspices of the electrical machinery committee. A fine paper on the safe loading of oil-immersed transformers was presented by E. T. Norris. He developed the relations between service temperatures, maximum safe output rating and the national standard rating. The hottest spot temperature is held to be the significant value and the author describes an instrument that can be used to measure this temperature, thus permitting transformers to be operated safely at higher than standard ratings.



Test Results of Motor Operated on Sinusoidal and Non-Sinusoidal Voltages
(Doggett and Queer)

An analytical paper on the operation of an induction motor with non-sinusoidal impressed voltages was presented by L. A. Doggett and E. R. Queer. The effect of harmonics are studied and the conclusion reached that if they are 10 per cent or less their effect is negligible, except at the no-load condition. It was also found that lightly loaded motors tended to smooth out the voltage wave.

Another analytical paper, dealing with magnetic fields for conductors in slots, was presented by B. L. Robertson and I. A. Terry. The equations of Poisson and La Place are applied to cross-sections of current - carrying conductors in rectangular slots to show the flux distribution. The theory is built up in a thorough manner and alternative cases of flux distribution effects are treated analytically. Design formulas are found to give value of slot inductance that is about 96 per cent of those found by the analytical treatment and the authors develop a formula to show the error to be expected for any particular case.

One of the new developments of the year is the use of outdoor types of hydrogen-cooled synchronous conden-

sers. This was described in a paper by R. W. Wieseman. It is found that a machine can be operated at a larger load at the same temperature when using hydrogen as a cooling medium instead of air. This gas has high thermal conductivity, gives forced heat connection, reduces the corona action and is safe from explosive hazards. Tests show rotor windage losses are reduced about 8 per cent as compared to rotation in air. The machines in service have operated satisfactorily and others are being built. The leakage of hydrogen has been reduced to a negligible amount and the equipment is ready for many application without further refinements.

The short-circuit torque in synchronous machines without damper windings was the subject of a paper by G. W. Penney. This torque is pulsating and the average value is determined by the losses, but the instantaneous values may be many times larger. The torque is produced largely by stored magnetic energy and the author derives general equations for an ideal machine. In salient pole machines the calculation of actual torque is made by a step-by-step method because of the variable nature of the armature in distance. Calculations based on constant self-inductance are shown to be in serious error. A general semi-graphical method of solution is developed.

In the discussion of Mr. Norris' paper it was pointed out that the Institute is now preparing recommendations for the operation of transformers with the aid of temperature indicators. Several representatives of American manufacturers stated their belief that the present Institute rules are not unduly conservative. The general opinion was that for continuous loading the maximum allowable temperature shown by indicators should be below 110 deg. C.

Metal-Clad Switchgear Uses Standard Type Breakers

By R. R. Vrla

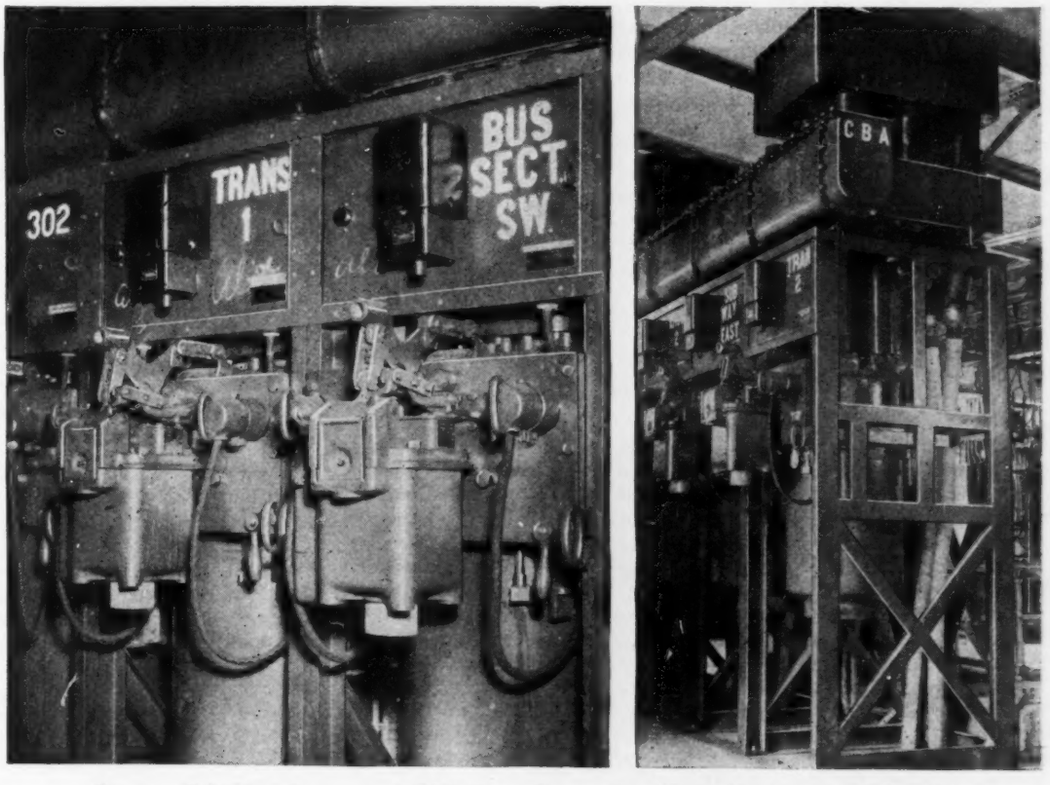
Superintendent Electrical Construction
Rochester (N. Y.) Gas & Electric Corporation

A RECENT short-circuit study of the system of the Rochester Gas & Electric Corporation indicated a definite weakness in the 4,150-volt bus and connections in substation No. 6. A careful study of the various types of oil switches which might be used under the existing conditions, where floor space offered the limiting factor, led to the decision that metal-clad switchgear was best adapted from operating, construction and safety viewpoints.

The metal-clad switches selected are designed to carry General Electric type K-55 oil circuit breakers with three phases in a single 20-in. round tank. These breakers are oil tight, the internal mechanism—that is, the crosshead, blade rods and other parts of mechanism—being fully inclosed. The solenoid mechanism, of course, is not inclosed in the breaker shell. The breakers are provided with an exhaust chamber through which the gases generated by a heavy overload or short circuit are vented. This exhaust chamber is automatically coupled to a header when the breaker shell is installed. All live parts except the main disconnecting switch are immersed, No. 6 oil being used in breaker tanks. Petrolatum is used in current transformer, potential transformer and bus chambers.

This type of switching unit provides for removing the oil circuit breaker unit as a whole (tanks and solenoid). Each unit has a separate section of bus properly insulated, taps being taken to the oil switch disconnecting bayonets through the oil switch on one side and through the current transformer to outgoing cable on the other. When the potential transformer is installed a housing is placed over the current transformers and taps taken from main line through fuses and resistors to the potential transformer. The potential transformer shell is filled with petrolatum after the cover is closed.

The secondary wiring disconnecting devices are not automatically engaged when the breaker is inserted, but must be plugged in by hand. After being connected the breaker may be raised or lowered without affecting the control circuit. These disconnecting devices are of train coupler type attached with flexible cable.



Space Limitations and Higher Capacity Requirements Met by 4,150-Volt Metal-Clad Switches

600-amp. breakers are used on regulated circuits, while 800-amp. equipment is provided for the 11,000/4,150-volt transformers.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Pulverized Coal Plant at the Peterborough Electricity Works.—The new power station of the Peterborough Corporation (England) is said to be unlike any other station in the United Kingdom, specifically in that it is not connected with any other source of electrical supply and yet relies entirely upon the use of pulverized coal as a fuel. This station is also said to be the first one in Europe to follow the recent American trend toward and elimination of the division between the turbine and boiler rooms. Overhead bunkers have been completely eliminated since there is no coal storage in the boiler house, the coal being stored in the large pulverized fuel bunker in the pulverizer house. Air for combustion is not taken from the boiler house but from outside, it being felt that the thermal advantages did not offset the improvements in ventilating results. Special provisions have been made for the pulverizing and ash disposal, the former including multiple ball type pulverizers and the latter a sluicing system which delivers the ash to a settling pond on the far side of an adjacent river.—*Engineer (England)*, May 24, 1929.

Research in Mechanical Engineering by Small-Scale Apparatus.—F. C. JOHANSEN.—A study of a number of the various elements involved in the use of small-scale apparatus for research work with particular reference to hydraulics and allied subjects. The flow in pipe, the flow in open channels, pulsating pressures, weirs and orifices, sluiceways, centrifugal pumps and similar devices have been considered. The author has developed mathematical expressions for certain relationships in a number of these instances.—*Engineering (England)*, May 24, 1929.

Generation, Control, Switching and Protection

New Method of Limiting Short-Circuit Current.—K. KUPPERS.—With the growth of power stations and power systems, methods had to be devised whereby a short-circuit could be limited to a reasonable and readily controllable amount of current. Current-limiting reactance coils, connected in series with generators, transformers, feeders or sections of busbars, found wide application for this purpose. The outstanding disadvantages of these coils are the undesirable effect upon voltage regulation, an increase of inductive load, their large size and high cost. All of these effects become particularly noticeable for relatively low voltages between 500 and 3,000 on account of the high rated current for which they have to be wound. A new and more suitable method was advanced by the author by the use of ohmic resistors, which are made of material of pronounced positive temperature coefficient, such as, for example, pure iron. Swedish charcoal iron was found satisfactory, because its ohmic resistance rises over eightfold when heated to 800 deg. C. Ribbons of this iron are so dimensioned as to rise to cherry red heat (800 deg.C.) just before the main breaker trips, which may be a matter of one to two seconds. A danger of melting is not reached until the ribbon reaches 1,500 deg. This danger may only be expected if either the resistor is unsuitably dimensioned in regard to the setting of the breaker or if the breaker fails to trip. In either case the customary inductive reactor would be destroyed and would be a total loss, while a burned-out resistor can be cheaply replaced by a new ribbon of steel. Three of the largest German electrical concerns are building these resistors, construction and installation pictures of which are shown in the article. The only indicated disadvantage of these resistors is the slightly higher loss, but since the difference is always only a fraction of 1 per cent it has no important significance. — *Elektrotechnische Zeitschrift*, May 9, 1929.

Transmission, Substations and Distribution

Overhead-Line Protection.—L. F. RATCLIFFE.—In this discussion the author has advocated an increase in the factor of safety of machines and other equipment in order to guard against atmospheric surges rather than the provision of lightning arresters. In order to develop the contention the author has made a study of the origin of surges, the production of the surge by atmospheric effects, the nature of surges and various protective elements. It is concluded that the velocity of the traveling waves or surges will be of the order of 40,000 to 180,000 miles per second; the maximum voltage surge possible upon an overhead line system is limited by impulse flash or spill-over value of the supporting insulators; the current created by this voltage surge depends upon the surge impedance of the system, which is generally of the order of 400 ohms, and if this figure is adopted the maximum surge current possible is limited to 2½ amp. for every 1,000 volts of surge pressure. It is stated definitely that the result of years of experience upon hundreds of miles of overhead lines clearly indicates that the procedure of increasing the factor of safety of machines and transformers connected to overhead lines is, generally speaking, from an economical and technical point of view better than the provision of lightning arresters.—*Electrical Review (England)*, May 17, 1929.

Illumination

Influence of Colored Light upon Working Efficiency.—W. RUFFER.—Systematic tests were made on twelve employees of an electric lamp works to determine whether or not the color of light has any marked effect upon the performance of certain routine work. The employees were carefully selected for perfect sight and absence of color blindness. The tests consisted of arranging small pieces of wire, of stringing small beads, and for quickness of vision the Langdold ring was used. All tests were made in a room about 9 ft. x 12 ft., which was uniformly illuminated with five sets of incandescent lamps of the following colors: Daylight lamps, blue, red, yellow and green. Excluding fatigue, no difference was noticed, as soon as the men became accustomed to any particular hue of light in the room. If, however, colored bench lights were used, individual selection of the light hue may be successful. In this case yellow light gave highest averages.—*Elektrotechnik und Maschinenbau*, May 5, 1929.

Motors and Control

Phase Advances of the Scherbius Type.—W. CRAMP.—The Scherbius phase advancer has recently been adopted as a permanent addition to certain types of three-phase motor. The author gives a simple theory of the advancer and applies the equations to an analysis of an all-watt motor. It is shown that quantities usually regarded as constants are not constant in actual practice. In this connection the effect of brush resistance and saturation of the advancer iron are dealt with. When the variations thus induced are taken into consideration the agreement between prediction and test data is said to be close, but the locus diagram of primary current no longer follows the arc of the circle, although it can be arrived at from a series of such arcs.—*Journal of the Institution of Electrical Engineers (England)*, June, 1929.

Textile Plant Electrification.—CLIFFORD CARTER.—The author has considered some aspects of mill and factory drive for which the electric motor is particularly suited and has likewise given consideration to generated versus purchased power, group or individual drive, modern mill motors and similar factors. The special requirements of drive and control for weaving, two-loom belt drives, individual chain drives, integral mounting and group drives for looms have been considered. Particular attention is devoted to devices which have been developed to aid the textile engineer in the application of electricity to test and production work.—*Electrical Review (England)*, May 31, 1929.

News of the Industry

Banking Relations Up

Federal Trade Commission Files Letters from J. F. Owens and A. F. Hockenbeamer to A. W. Robertson on A.I.E.E. Committee Work

DOCUMENTARY evidence presented last week at the Federal Trade Commission's final hearing before recess supplied more paper wadding for the journalistic big-gun barrage against the "power trust." An attempt to gain financial and political control was seen in selected quotations from letters between utility association heads who were striving to promote good will with bankers throughout the nation.

One letter from J. F. Owens, chairman of the Public Relations National Section, N.E.L.A., to A. W. Robertson, president of the Philadelphia Company, to arrange a program for the committee on relations with financial institutions, stressed the need for closer attention to rural banks in addition to that already given to metropolitan banking houses. The village banker, it was pointed out, not only has influence in his own community but usually is in somewhat close contact with local delegates to the State Legislature or to Congress. He can be of aid in loosening the restrictions governing the purchase of utility securities by trust and savings banks and in the drive toward customer ownership, wrote Mr. Owens.

"In California we 'discovered' the country banker quite a number of years ago," said A. F. Hockenbeamer, president of the Pacific Coast Gas & Electric Company, also in correspondence with Mr. Robertson on the committee activities. "We have accounts with 230 country banks scattered all over our territory. While our policy keeps an average of around a million and a half dollars tied up in these country depositaries without interest, we think it is well worth while because their service as bankers is worth something and because it cements their friendship and co-operation." Mr. Hockenbeamer said his banking relations had been "as cordial as they possibly could be" and had been invaluable in helping defeat the much-controverted California water and power act. "They know as well as we do the economic dangers against which we must present a united front."

Another letter told of the payment of $50,000 by Western power companies to the Graduate School of Business of Stanford University. This was construed as school influence without attention to the fact that the Stanford business school is largely supported by West Coast industries, of which the utilities are only a part, for the purpose of augmenting the limited supply of young men trained along executive lines.

Other miscellaneous material was introduced for the record. On adjournment, June 27, the next hearing was set for September 10, when a few more witnesses will be heard on the propaganda phase of the investigation. The power companies' rebuttal testimony, postponed till fall at their own request, is expected to follow. Field and office work on both the publicity and financial phases will be continued during the summer by commission employees.

General Electric Enters Agreement with German Firms

Press dispatches from Berlin report that an important agreement has been reached between the General Electric Company on one side and the Allgemeine Elektricitäts Gesellschaft, Siemens & Halske and Koppel & Company on the other. The German companies had owned all the shares of the Osram company, lamp manufacturer, of which General Electric has just bought 16 per cent. The agrrement provides for closer technical and commercial co-operation in production as well as distribution.

Clark H. Minor, president of the International General Electric Company; Owen D. Young, chairman of the board, General Electric, and Gerard Swope, president of General Electric, have been appointed members of the board of directors of Osram.

Body to Survey New York Commission Complete

The body provided for by the New York Legislature at its last session to make a survey of the Public Service Commission and the laws governing it has been completed by Governor Roosevelt, to whom was delegated the appointment of three members. He has selected Frank P. Walsh of New York City, Prof. James C. Bonbright of Columbia University and David C. Adie of Buffalo. Mr. Walsh is a Democrat who was appointed chairman of the Federal Commission of Industrial Relations by the late President Wilson in 1913. Professor Bonbright, regarded as independent in politics, is a member of the faculty of the School of Business at Columbia University. Mr. Adie, the Governor's nominee to the Public Service Commission whom the Senate refused to confirm in March, is an independent Republican and executive secretary of the Council of Social Agencies in Buffalo.

The Governor's three appointees will serve with Senator John Knight, leader of the Senate, Senator Warren T. Thayer of St. Lawrence, Senator William J. Hickey of Buffalo, Speaker Joseph McGinnies of the Assembly, Assemblyman Horace M. Stone of Onondaga and Majority Leader Russell G. Dunmore of Utica, all Republican chiefs in the Legislature.

The commission met for organization on July 2. Senator Knight was elected chairman. William J. Donovan will be counsel. Partisan friction arose over the selection of technical aides.

Probably the first proposal placed before it will be for the development of a measure to give the Public Service Commission effective regulation and supervision of holding corporations which have sprung up in this state since the passage of the original Public Service Commission law under the administration of Governor Charles E. Hughes.

New York Attorney-General to Scan Morgan Merger

Governor Roosevelt of New York has transmitted to Attorney-General Hamilton Ward of the state a letter calling attention to the announcements appearing in the public press of the proposed merger of the Northeastern Power Corporation, the Buffalo, Niagara & Eastern Power Corporation and the Mohawk-Hudson Power Corporation, forming the Niagara-Hudson Power Corporation. The Governor raises the point that the "present proposed merger, as well as the immediately previous consolidations, may be such a monopoly as is forbidden by the provisions of the general business law and the stock corporation law." He requests the Attorney-General to make an immediate investigation and submit a preliminary report within two weeks.

The Governor holds that the merger "is a matter of vital concern, not only to the commercial and manufacturing interests of the state, but also to every householder of the state who uses electric light or power in his home." He says that it may possibly prevent decreases in present rates "which might be practicable except for the existence of these recent mergers." "This is particularly important," the Governor adds, "in view of the limitations placed on the Public Service Commission concerning control and supervision over holding companies."

"It must also be borne in mind," the letter says, "that the State of New York, which is the owner of considerable de-

veloped and undeveloped water power, may, when the question of transmitting this power arises, be compelled to deal with a practical monopoly on terms likely to be dictated by that monopoly." The developed power resources to which the Governor refers are the sites at Vischer Ferry and Crescent Dam on the State Barge Canal, the power of which is sold by the state under contract to the New York Power & Light Corporation. The principal undeveloped site outside of the Adirondacks and Niagara is that claimed by the state in the St. Lawrence River.

A formal statement received by telephone from Attorney-General Ward at Buffalo was given out at his Albany office. It said: "I am at the present time in Buffalo working on the investigation of the power merger requested by Governor Roosevelt and shall be able to make a preliminary report within the suggested time. I will be in Albany on July 8 to make a preliminary report to the Governor."

University Professors Speak at Seattle

Undeterred by Echoes from the National Capital, Dr. Burd Urges Sound Advertising Principles and Karl E. Lieb Pleads for New "Measuring Stick"

WITH emphasis on the various aspects of public relations and with the introduction of the talking motion picture as an important adjunct of a convention program, the Northwest Electric Light and Power Association concluded its twenty-second annual convention (briefly noticed last week) on June 28 at Seattle. The convention, which lasted three days, drew a total registration in excess of 750, the largest in the history of the Northwest Geographic Division of the N.E.L.A.

Urging as one of the seven cardinal duties of the public utility industry a vigorous attack against the entry of government into private business, W. H. McGrath, vice-president Puget Sound Power & Light Company, asserted in the opening address of the convention that government ownership was "constitutionally unsafe, politically unwise, economically unsound and competitively unfair." Franklin T. Griffith, president Portland Electric Power Company, recommended a word-of-mouth campaign by every member of the industry to counteract unfair newspaper interpretations of the industry's acts. Declaring that it is not the government itself which is interfering with business but rather individuals who have won a place on the government payroll they desire to hold at any cost, R. M. Boykin, president of the association, in his annual address, analyzed some of the dangers of the district power bill which will be voted on by the people of Washington in 1930.

Dr. Henry A. Burd, University of Washington, discussed the public attitude toward the power companies, showing wherein this attitude is different from that held toward businesses which are not natural monopolies. He urged the intelligent application of sound advertising principles as one way of bringing the public point of view into harmony with the industry's aims and purposes. In discussing the Federal Trade Commission's investigation, Paul S. Clapp, managing director N.E.L.A., said that the industry would be remiss to its investors and to itself if it did not continue to inform the public and to combat with full vigor the aggressions of government ownership advocates.

The program of the first session concluded with talking motion pictures showing the opening of the N.E.L.A. convention at Atlantic City and giving an address by President M. S. Sloan, greetings from Thomas A. Edison and a defense of private ownership by Sir Ernest Benn.

At the second session, when the accounting, commercial and engineering phases of the industry were debated, Prof. Karl E. Lieb, University of Washington, made a plea for finding a measuring stick of efficient management other than the customary arithmetical average of earnings per kilowatt-hour. He declared that when such a measuring stick was devised the public and the utility would both benefit from increased efficiency.

In reviewing the work of the Public Relations Section at the third session, W. H. Ude, Washington Water Power Company, Spokane, pointed to the conduct of public speaking and essay contests as the principal features. Finals in two public speaking contests on "The Public Utility a Good Citizen" and "How Can I Best Serve Our Customers?" formed an interesting part of the program.

Norwood W. Brockett, director of public relations, Puget Sound Power & Light Company, thought that the industry had laid too much emphasis on the public relations problem, with the result that the public has become suspicious. George E. Erb, former chairman of the Idaho Public Utilities Commission, discussed maintaining amicable relations with the public, and J. F. Owens, vice-president N.E.L.A., drew attention to the human values involved in the public contacts of the thousands of utility employees.

The all-day boat trip to Victoria, B. C., where the British Columbia Electric Railway Company acted as host to the delegates, was greatly enjoyed. The final session was held on the boat. D. W. Proebstel, Portland Electric Power Company, chairman of the Engineering Section, reviewed its accomplishments, and D. K. Blake, General Electric Company, discussed the economics of distribution. A. Edwin Foin, New York City, spoke on "Psychological Merchandising."

Officers elected are: President, M. L. Hibbard, Idaho Power Company, Boise; vice-president, M. W. Birkett, Washington Water Power Company, Spokane. A. C. McMicken, general sales manager Portland Electric Power Company, was elected to honorary membership in recognition of 21 years of active service to the association.

Edison Retains Ownership of His Birthplace

Though willing to vest in the State of Ohio a "protectorate" over the cottage at Milan in that state in which he was born, Thomas A. Edison has declined to sell it to the state, which desired to preserve it as a memorial to the inventor. This is the outcome of a visit to Milan by William H. Meadowcroft, Mr. Edison's executive secretary, to confer with a joint committee of state legislators authorized to negotiate for the property. Mr. Edison's counter-proposal was favorably received by the committee members, and Senator Bender, the chairman, will so report to Governor Cooper. The little red-brick house, with a garden plot in the rear, is now occupied by Miss Marietta Wadsworth, a relative of Mr. Edison's.

New Hampshire Appoves of Hydro Exportation

Permission to export hydro-electric power from the Granite State to Massachusetts has been authorized by the Public Service Commission of New Hampshire in a decision on behalf of the Grafton Power Company, a subsidiary of the New England Power Association. This finding opens the way to the transmission of energy from the Fifteen-Mile Falls development now under construction to the Boston district and other areas served by the New England system outside New Hampshire. The commission assured itself that New Hampshire industries would not suffer from power shortage before granting the privilege of exportation, and the terms of the order make due provision for such a contingency in the future, both as to price of energy and to volume available for local use and by other New Hampshire utilities that may desire to buy power from the New England system.

The total annual output of the completed Fifteen-Mile Falls development will be about 400,000,000 kw.-hr. primary and 150,000,000 kw.-hr. secondary power. The Boston Edison company has contracted for 150,000,000, kw.-hr. per year from the New England Power Association. The present generating capacity of the association is 575,000 kw., of which 200,000 kw. is in hydro plants.

Strides of Farm Service in Michigan

Record This Year Will Equal That of Past Twenty—State N.E.L.A. Convention at Mackinac Island Hears Encouraging Reports and Outlines of Policy

THE Michigan Electric Light Association held the most successful convention in its history at the Grand Hotel, Mackinac Island, in conjunction with the Michigan Gas Association, on July 1 to 3. Total registrations for both conventions were 509.

Michigan is making greater progress this year in taking electric power to the farm and adapting it to farm operations than in the past twenty years, Prof. H. J. Gallagher, Michigan State College, declared. Ten thousand farms will be served with electricity for the first time this year, he said, involving a total expenditure of about $5,000,000. President Howard Pett reported that 1,500 miles of rural service line will be built this year. "The utilities of Michigan have a broader perspective than immediate dollar return on farm service investment," Professor Gallagher said, "and through their willingness and desire to serve agriculture on a basis within the earning scope of the farmer they will do more toward establishing balance in agriculture than would any farm relief bill passed by Congress."

L. C. Moore, holder of a farm electrification fellowship at Michigan State College, described research work carried on. Walter R. Carven, leader in the farmers' Mason-Dansville test line, said that nothing contributes as much to the comfort, happiness and wellbeing of the farmer as electricty. Fred W. Bagnall, Detroit Edison Company, and F. W. Pollock of Stevens & Wood, Inc., described methods employed to reduce costs of building electric lines to serve farm customers.

President Pett, in his address, said that in recent criticisms of electric industry "the outstanding facts about our industry are lost sight of—namely, that in each year since 1890, with the exception of the war period, the average price for electricity for home use has decreased. With practically no exception, the attitude of Michigan newspapers is eminently fair toward public utilities," he said, "and member companies are enjoying the confidence of the communities they serve." Mr. Pett quoted figures showing that Michigan companies quite generally have adopted the inducement type of rates, encouraging greater use of energy for cooking, refrigeration and appliance uses in the home.

At a joint session with the Michigan Gas Association W. J. Hagenah, vice-president Byllesby Engineering & Management Corporation, spoke on "Public Utility Regulation and Its Accomplishments." Mrs. Siegel W. Judd, president Michigan League of Women Voters, said that increasing consideration of domestic rates and extension of domestic use of power on the part of utility leaders were most encouraging.

A. C. Marshall, Detroit Edison Company, told the joint session that the Michigan Public Utility Information Bureau fills a definite need by giving the utilities a central source for the issuance to the public of facts concerning utilities and would be continued with the same policies laid down at its founding. Arthur W. Stace, director, outlined the work and objects of the bureau.

Purchases and Mergers

Tennessee Properties of Cities Service Company Consolidated in Tennessee Central Service Company—Offer for Columbus Electric & Power

ORGANIZATION by the Cities Service Company — the Doherty holding company—of the Tennessee Central Service Company is reported. The new company, capitalized at about $10,000,000, will consolidate the following nine electric light and power subsidiaries operating mainly in east Tennessee, with headquarters at Bristol: Bristol Gas & Electric, Tennessee Eastern Electric, Elk Park Light & Power, Erwin Light & Power, Butler Electric Light & Power, Newland Light & Power, Roans Creek Light & Power, Bluff City Electric Light & Power and Watauga Power. The Johnson City Traction Corporation is also included.

A conditional offer for the common stock of the Columbus (Ga.) Electric & Power Company has been made by the Commonwealth & Southern Corporation. Stone & Webstser, owners of a substantial interest in the Columbus company, will act as a depositary for Columbus shares.

Officials of the Insull companies promptly denied last Saturday that there was any truth in newspaper stories of an approaching merger between Insull interests and the North American Company, which controls the chief electric light and power companies in Cleveland, Milwaukee and St. Louis and other electric utilities.

The Connecticut Public Utilities Commission has approved the merger of the Eastern Connecticut Power, Uncas Power, Gaylordsville Electric and Kent Electric Light & Gas companies with the Connecticut Light & Power Company. All are Hartford concerns under the same control. The merger will be effective about August 1.

An offer of $400,000 for the Radford (Va.) municipal electric plant has been made to the city by representatives of the same Massachusetts power company that some time ago bid $375,000 for the property. The city officials have not divulged the name of the bidder.

Regrouping of properties of the Iowa Public Service Company, Sioux City, and the Northwestern Light & Power Company, Cedar Rapids, through a wide territory in northwestern Iowa has been effected with the idea of promoting rural service. The Northwestern Light & Power control in Alvord, Boyden, Blencoe, Correctionville, Doon, Bronson, Lawton, Danbury, Hull, Granville, Moville, Pierson and Smithland passes to the Iowa Public Service, which relinquishes its control in Gillett, Grove, Terrill, Milford, Orleans, Dickens, Fostoria, Arnolds Park, Superior, Langdon, Montgomery, Spirit Lake and Manhattan to the Northwestern Light.

Merger of the municipal plant at Larabee, Iowa, with the Iowa Public Service Company group was authorized by citizens of Larabee at a special election last week at which the proposal carried four to one.

The queustion of whether Pierre, S. D., shall sell its municipal electric light and power plant will be voted upon July 9 instead of July 2, as previously reported.

Hydro and Texola, Okla., recently voted to sell their municipally owned electric systems to the Southwestern Light & Power Company. Properties at Hydro transferred to the company include the city-owned light and power plant, distribution lines and ice plant. The company acquired at Texola the municipal electric distribution system and 8 miles of 6,600-volt single-phase transmission line.

The Rocky Mountain Utilities Company, a subsidiary of the Commonwealth Utilities Corporation of St. Louis, has asked the Colorado Public Utilities Commission for permission to take over and operate the municipally owned electric plants in Hugo, Arriba, Flagler and Seibert, Colo., subject to the voters' approval.

The Public Service Company of Colorado has purchased the Gilpin County Light, Heat & Power Company of Denver, serving the towns of Black Hawk, Central City, Nevadaville and Russell Gulch. This is a mining section of the state.

By the acquisition of the National Utilities Corporation, controlling the electrical plants at Port Alberni, the city of Alberni and other British Columbia points, the British Columbia Electric Railway Company has gained control of all Vancouver Island utilities with two exceptions, the Canadian Utitities, Ltd., operating in Nanaimo and Duncan, and the Puntledge hydro-electric development of the Canadian Collieries, Ltd., which serves Courtenay. The purchasing company will control power in seven of the twelve municipalities on the Island. The Royston Light & Power Company and Parksville Light & Power Company are included in the recent change of control.

In the Legislative Mills

FLORIDA.—The State Legislature, which was called into a twenty-day extra session by the Governor following the regular adjournment, has adjourned ***sine die***. The bill providing that power companies must get easements over private property before stringing high-tension lines failed of passage. A like fate met the proposed law placing all power companies of the state under the jurisdiction of the Florida Railroad Commission.

OKLAHOMA. — A bill defining "public utilities" and making certain exceptions in relation to contracts in Washington County, Okla., has passed both houses and is before the Governor.

WISCONSIN.—The Assembly has passed by 56 to 31 the Reis bill making the eighteen electric utilities in Wisconsin that own and operate street-railway systems pay their property taxes at the local rates, instead of at the average state rate of 19.6 mills. The Lower House has now adopted and sent to the Senate the last of the various utility measures sponsored by the Wisconsin League of Municipalities.

Many Applications Before Power Board

Contest for Rights on Chattahoochee—Thirty Projects on Colorado Seek Lifting of Blockade—Columbia River Undertakings—Low-Head Plant for Florida

CONFLICTING applications for rights on the Chattahoochee River near West Point, Ga., will be considered at a public hearing July 16 before the chief engineer of the Federal Power Commission. The executive secretary recently notified the two applicants that the project put forward by J. Smith Lanier appears the more desirable, since it provides for flood control. The Columbus Electric & Power Company, the other applicant, protested against action in line with the executive secretary's statement and requested that a hearing be held.

The chief counsel of the commission is studying the Colorado River situation with a view to the formulation of a formal opinion covering the status of the projects on that river—more than 30 in number—which have been held in abeyance pending the settlement of the Boulder Canyon question. Doubt exists as to whether the proclamation of the President making effective the Boulder Dam act automatically raises the ban imposed by Congress upon all other Colorado River projects. Some are of the opinion that no action on Colorado River applications can be taken until the Secretary of the Interior has concluded contracts for the sale of the power.

The city of Ottumwa, Iowa, has applied to the commission for a license covering a 4,000-hp. project on the Des Moines River for which it holds a preliminary permit. When the new power house is completed the output is to be sold to the Iowa Southern Utilities Company.

Application has already been made by the Washington Electric Company of Seattle for a license covering a proposed development on the Columbia River. This application for license reaches the commission before action has been taken on the application for a preliminary permit. It indicates that the applicant has completed engineering studies and is in a position to present the detailed figures for consideration. The project consists of two dams across the Columbia River at Rock Island, 12 miles downstream from Wenatchee. One of the dams will extend from the left bank to the island and the other from the right bank to the island. The power house will be an integral part of the left-bank dam. The initial installation will be 80,000 hp., but provision will be made for the installation of an additional 120,000 hp. The pool will extend upstream 20 miles and will cover 3,030 acres. The power is to be sold to the Puget Sound Power & Light Company for public utility use.

J. N. McDonald of Sarasota, Fla., asks for a preliminary permit covering a low-head development in the Oklawaha River, near Orange Springs, Fla., below the plant of the Oklawaha Reclamation Farms on Moss Bluff. He proposes to construct a dam 35 ft. high and 5,500 ft. long. The installation of a navigation lock will be necessary. Mr. McDonald desires to install 16,000 hp.

The Washington Water Power Company of Spokane has applied for a license covering two constructed transmission lines. One is 49 miles long, operating on 110,000 volts, connecting the company's substation at Stratford with the line of the Chelan Electric Company. The California-Oregon Power Company asks for a license for a constructed 33,000-volt transmission line extending from Grant's Pass to Marble Mountain and also for a license covering a constructed 66-kv. transmission line, 38 miles long, extending from the Prospect No. 2 power plant of the company to the Ray power plant in Jackson County. The Telluride Power Company of Salt Lake City asks for a license covering certain constructed transmission lines in Beaver, Piute, Sevier and Millard Counties, Utah. The aggregate length of these lines is 217 miles, and they operate at 44,000 volts.

The Mount Hood Electric Company of Portland, Ore., asks a license for a short line on Mount Hood.

The Louisville Gas & Electric Company of Louisville, Ky., has applied for a license covering a constructed transmission line extending from the plant of the Louisville Hydro-Electric Company to the Waterside steam station of the applicant. The line operates at 132,000 volts.

Hyrum City, Utah, has applied for a license covering the project for which it recently asked a preliminary permit. All necessary data upon which to base the application for license are thought to be in hand. It is proposed to install 600 hp. to be used for municipal lighting and power purposes.

Licenses are asked for three small projects of less than 100 hp. each: By D. A. Syme, Phoenix, on Showbow Creek, Ariz.; by the Eagle River Power Company, on Gypsum Creek, Colo., and by Addison Brown and C. J. York, Downieville, Calif., in Slug Canyon.

Kentucky Utility Men Favor a State Commission

Regulation of utility operations in Kentucky by a state commission was advocated and opposed recently at a public hearing held in Louisville by the special Senate committee appointed at the last session of the General Assembly to consider the advisability of regulatory legislation.

Representatives of utility companies, including the Louisville central stations, attended, and those of them who spoke at the hearing appeared favorably disposed to commission control, provided the commission be composed of the right kind of men and vested with sufficient authority. However, some of them also expressed the opinion that the present constitutional salary limitation in Kentucky is almost prohibitive of success in obtaining a competent body to handle utility problems. No interest was manifest at the hearing on the part of the small towns or the second-class and third-class cities, which, it had been maintained, needed a commission for their protection.

At the suggestion of T. B. Wilson of the Louisville Gas & Electric Company, it was decided to send a questionnaire on the subject to every municipality in the state. If the response is insignificant, the chances are that the committee will report back that there is no need of such a commission and little interest in the idea.

Details of Lackawanna-Public Service Contract

Further details of the forthcoming electrification of the Delaware, Lackawanna & Western Railroad are announced by Public Service Electric & Gas Company as follows:

The contract entered into with Public Service provides for the supply for twenty years of all the power used by the Lackawanna between Hoboken and Maplewood, while the Jersey Central Power & Light Company and the New Jersey Power & Light Company will supply the requirements beyond Maplewood. Public Service will furnish alternating-current electricity from its Marion power station over three cables to a substation to be built by the Lackawanna at Bergen Junction, Jersey City, and from its recently constructed West Orange switching station over two cables to a substation to be built near the Roseville Avenue station in Newark. In these substations the Lackawanna will use mercury-arc rectifiers to convert the electricity to direct current for the supply to its overhead trolley system. The Lackawanna's engineers estimate that the power requirements to be supplied by Public Service will be about 15,000 kw. of demand and that during the year 35,000,000 kw.-hr. will be used.

The present plans are for electrification of the Morris and Essex division from Hoboken to Dover by way of Morristown, the Montclair branch from Roseville Avenue to Montclair, and the Passaic and Delaware branch from Summit to Gladstone. The contract also includes light and power for the railroad's stations and shops and for the large terminal warehouse now being constructed at the Hoboken terminal.

Work has already been started by the railroad at Montclair, Hoboken and west of Newark. A year is the minimum time extimated for its completion. It will cover 78 miles of roadway, comprising 173 miles of track, and cost between $14,000,000 and $18,000,000.

New York Edison Sole Bidder for Subway Contract

As anticipated, only one bid for the supply of power to the new subway lines now being built by New York City was received when the bids were opened by the Board of Transportation last week. This was from the New York Edison Company, and the figure set was 7.99 mills a kilowatt-hour on the proposed ten-year contract. The Interborough Rapid Transit and Brooklyn-Manhattan Transit companies; which operate the present subways, did not bid, not being in a position to expand their generating plants sufficiently.

The Edison bid, which is thought certain of acceptance, will bring the city's light and power bill on the new subway to $514,595 in 1931, the first year of the contract, according to estimates of the Board of Transportation engineers. The estimated cost for 1940, the final year of the contract, is $6,309,703. The cost, it is estimated, will increase steadily from 1931 on as various sections of the new subway system are placed in operation. Over the ten-year period the total estimated cost is $39,235,329.

Interconnection Wins the Day Against Texas Floods

The value of interconnected transmission lines when emergencies arise was again demonstrated during recent severe floods in the wide area served by the Central Power & Light Company of San Antonio, Texas. The Guadalupe River broke from its banks on May 29 at Gonzales, inundating the hydro plant to a depth of four and one-half feet, and a few hours later the same conditions were present at Cuero, but except for a minimum interruption in Gonzales, electric service in both towns was totally undisturbed.

The force of the flood had somewhat abated by the time Victoria was reached, and though the steam plant was seriously threatened, it was not flooded and electric service there was maintained without interruption. The Colorado River was also at a very high stage, but disaster was successfully avoided at Bay City, Columbus, Eagle Lake and other rice belt district towns served by the company.

All traffic except by boat was suspended in the flooded area, and when it became necessary at Gonzales to change a cross-arm which had been shattered by lightning, on the Oak Forest-Nixon line, the work had to be done from a motorboat. One of Victoria's most trying problems was the moving of approximately two hundred poles, measuring 35 ft. to 60 ft. in length, to higher ground, lashing them together and anchoring them to trees and other secure objects.

In other floods, less serious than the one just experienced, when local plants were the sole source of electric power, service was at a standstill, industries being closed and homes dark for a week at a time. During the flood described, even though the plants at Gonzales and Cuero were flooded, with generating plants and other equipment almost entirely submerged, industries operated as usual and homes were served as in normal times. While all were not actually flooded, every Central Power & Light Company district, except that of the Big Bend, was affected by the high waters of swollen creeks and rivers. Automobile and train traffic was entirely stopped for several days and telegraph and telephone communications were badly impaired. That there were no electric service interruptions was due to the company's extensive system of interconnected generating plants.

Waterville Hydro Plant Is Nearing Completion

Seven months' more work will bring the completion of the Waterville hydro-electric plant, which the Carolina Power & Light Company has for about two years been building on the Big Pigeon River in North Carolina near the Tennessee border. This plant, about 12 miles from Watertown, is characterized by a thin-section concrete arch dam 200 ft. in height to the top of the tainter-gate piers and about 900 ft. long from shore to shore. A 14-ft. pressure tunnel 6.2 miles long connects the reservoir with the power house, affording a static head of 861 ft. The dam is now complete, and work is being pushed on the tunnel and the power house. Work on the dam, built in a narrow rocky gorge, presented unusual difficulties because of the almost inaccessible nature of the site in the Great Smoky Mountains.

The power house is designed for the ultimate installation of three units with a total rating of about 75,000 hp. The initial installation will include two with 25,000 hp. capacity each.

Final Transportation Arrangements for Tokyo

Maurice Holland, executive secretary of the American committee sponsoring the World Engineering Congress at Tokyo, beginning October 30, announces that a second ship has been engaged to transport the official delegations from America and Europe, which with their families will number close to 300. The official ships, the *President Jackson* of the Dollar Line and the *Shinyo Maru* of the NYK Line, will sail from San Francisco on October 10.

The American party, numbering about 250, will leave New York for San Francisco on two special trains. The first, scheduled to depart on October 2, will proceed via Washington. Following a visit at the White House, where President Hoover as honorary chairman of the American committee will receive the engineers, the party will attend a reception and dinner given by the Japanese Ambassador, Katsuje Debuchi. The second section will leave New York October 6, proceeding directly to San Francisco via Chicago, joining the first section at San Francisco just before embarkation. The two ships will sail at the same time, and by special arrangement with the steamship companies they will stop at Honolulu for two days, arriving at Tokyo one day before the opening of the congress.

Agricultural Engineers Tell of Rural Electric Service

The Rural Electric Division of the American Society of Agricultural Engineers and the papers on subjects relating to power on the farm attracted considerable interest at the annual convention of that society in Dallas on June 24-27. The message of Arthur Huntington, public relations engineer with the Iowa Railway & Light Corporation, on "Where We Are Today in Agricultural Engineering," was not delivered to the general session as scheduled, owing to the absence of Mr. Huntington, but his paper will be included in the report of the convention.

R. W. Trullinger, assistant in experiment station administration, United States Department of Agriculture, presented a paper on "Research in Mechanical Farm Equipment, 1928," but the paper on "Research in Rural Electrification, 1928," scheduled from him, was not presented, owing to his inability to find time to prepare it.

With E. A. Stewart presiding as chairman, the Rural Electric Division held two sessions. Joe E. Ward of the Texas Power & Light Company presented a paper on "Rural Line Construction in Texas," in place of J. B. Thomas, chief engineer. This elicited an animated discussion over the need of good construction in power lines. The importance of safety was stressed by participants in the round-table talk. Service to rural customers has not offered much inducement to power companies in Texas, owing to the sparse population and mistrust of utilities by farmers, Mr. Ward said. Farmers are beginning to realize its benefits, however, and results during the past five years show improved social life resulting from the use of power. Five years ago there were virtually no rural power users in Texas, Mr. Ward asserted, while on May 1, 1929, the Texas Power & Light Company had four thousand rural customers and other utilities showed similar development.

The operation of model farms by his company was described by Richard Boonstra, agricultural engineer, Public Service Corporation of Northern Illinois. Representatives of power companies were also interested in the paper of C. T. Gilliam, Central Power & Light Company, on "Building a Rural Load in the South." "The National Project of Rural Electrification" was discussed by George W. Kable. E. A. Brackett, vice-chairman of the division, outlined its future program of activities.

Briefer News

PROGRAM OF ONTARIO HYDRO.—Addressing a gathering in Kemptville, Ontario, on June 22, Premier Ferguson announced that the provincial government would spend a sum of $1,500,000 on Hydro power this year and would build 1,200 miles of rural transmission lines.

GEOLOGICAL SURVEY WILL STUDY SALMON RIVER IN IDAHO.—Geological Survey engineers are this summer to study the power and reservoir possibilities of the South and Middle Forks of the Salmon River in Idaho, as part of a continuous investigation of the natural resources of that state which up to the present has involved the survey of 1,700 miles of rivers and 50 dam and reservoir sites, which are now represented on published maps.

COLUMBUS (OHIO) MUNICIPAL PLANT TO BE ENLARGED.—The Columbus (Ohio) City Council has authorized the purchase of a 7,500-kw. generator and other equipment for the municipal light plant. A bond issue of $115,000, passed by Council February 4, and another bond issue of the same amount, to be authorized during the last half of 1929, will furnish funds. The new machinery will replace older and smaller equipment, and the generator capacity of the plant will be increased one-third.

GEOLOGICAL SURVEY AND STATE WATER POWER.—Two new district offices have been set up by the Water Resources Branch of the Geological Survey, one in Hartford, Conn., and the other in Charleston, W. Va., making 30 in all. The Hartford district involves little water power, but in West Virginia hydro-electrically is predominant in many industrial developments which are in progress. In both states the Geological Survey will be aided by state appropriations and co-operate with state bodies.

HOW BEST TO ELIMINATE CINDERS.—In order to eliminate what the Salem (Ore.) City Council termed a cinder nuisance, the Charles K. Spaulding Logging Company has decided to expend $60,000 for the electrification of the firm's sawmill and box factory, which is within a few blocks of the business district. To correct the nuisance in any other way the company would have been required to bear the expense of installing special apparatus costing approximately $25,000. The Portland Electric Power Company will supply the power for the mill.

ANOTHER NEBRASKA INTERCONNECTION.—Preliminary work has been started on the construction of 70 miles of 66,000-volt transmission line to connect the Columbus (Neb.) generating plant of the Northwestern Public Service Company with the Riverside station of the Central Power Company at Grand Island. The line will be ready for operation about September 1, 1930, and will necessitate an ultimate increase in capacity by the Central Power Company at the Riverside station.

EXPANSION DETAILS FOR SOUTHWESTERN GAS & ELECTRIC COMPANY.—Construction work is being carried on in almost every division of the Southwestern Gas & Electric Company. For a coming 110-kv. interconnection with the Arkansas Power & Light Company right-of-way between Saratoga and McNeil, Ark., has been purchased. For connection between Shreveport and Minden, La., the survey has been completed. Towers for crossing the Red River at Bossier City, La., have been completed, and the 11,500-volt line is now operated on these towers, which will also carry the 110,000-volt line. New generating equipment of the oil-engine type is being installed at Mena, Ark., and Natchez, Miss.

Coming Meetings

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see page 46 of this issue.]

Wisconsin Utilities Association—Electric Section, Wausau, July 18-19. J. N. Cadby, 432 Broadway, Milwaukee.

Camp Co-operation IX — Association Island, Henderson Harbor, N. Y., Aug. 2-6. Society for Electrical Development, 600 Graybar Bldg., 420 Lexington Ave., New York.

International Association of Municipal Electricians—Statler Hotel, Boston, Aug. 20-24. H. N. Lang, box 1864, Orlando, Fla.

International Association of Electrical Inspectors, Western Section — Detroit, Aug. 26-28. W. S. Boyd, 175 W. Jackson Blvd., Chicago. International convention, Vancouver, B. C., Canada, Sept. 9-11. F. D. Weber, P.O. box 745, Portland, Ore.

National Association of Railroad and Utilities Commissioners—Glacier National Park, Mont., Aug. 27-30. J. B. Walker, 270 Madison Ave., New York.

American Institute of Electrical Engineers — Pacific Coast convention, Santa Monica, Calif., Sept. 3-6. F. L. Hutchinson, 33 West 39th St., New York.

Pennsylvania Electric Association—Bedford Springs Hotel, Bedford Springs, Pa., Sept. 4-6. H. A. Buch, Telegraph Building, Harrisburg, Pa.

Rocky Mountain Division, N.E.L.A.—Hotel Colorado, Glenwood Springs, Colo., Sept. 9-11. O. A. Weller, Public Service Co. of Colorado, Denver.

New England Division, N.E.L.A. — Hotel Griswold, New London, Conn., Sept. 9-12. Miss O. A. Bursiel, 20 Providence St., Boston.

Empire State Gas and Electric Association—Saranac Inn, Saranac Lake, N. Y., Sept. 19-20. C. H. B. Chapin, Grand Central Terminal, New York.

Illuminating Engineering Society — Bellevue-Stratford, Philadelphia, Sept. 24-27. A. B. Oday, 29 West 39th St., New York.

American Electric Railway Association —Atlantic City, Sept. 28-30. J. W. Welsh, 292 Madison Ave., New York.

Association of Electragists International—New Ocean House, Swampscott, Mass., Sept. 30-Oct. 3. L. W. Davis, 420 Lexington Ave., New York.

BEAUHARNOIS PROJECT IS ADVANCED A STEP.—Another step toward the construction of the Beauharnois power canal in Quebec Province has been taken with the signing of the order-in-council approving the agreement between the government and the company. The project involves the expenditure of approximately $65,000,000 in the construction of a power canal from Hungry Bay to Melochville. The company accedes formally to the terms and conditions embodied in the order-in-council passed some months ago but which was inoperative until accepted.

NIAGARA ELECTRIC SERVICE CORPORATION TO INCREASE ITS ENERGY SUPPLY.—Announcement is made by Joseph E. Montague, president of the Niagara Electric Service Corporation, that an increase of 30 per cent in the amount of electrical energy available to retail consumers will result from the addition of equipment in three of the company's substations by next November. These additions will be at the Eleventh Street, Beach Avenue and Welch Avenue substations and will permit the distribution of 6,000 additional kilowatts, making a total rating for the system of 28,500 kw.

ELECTRICAL PROGRESS IN ALBERTA.—The Calgary (Alberta) Power Company has 600 men working on its three-million-dollar Ghost River development and hopes to have the first generator in service in October. This company also means to build 500 miles of transmission lines varying from 13,000 to 132,000 volts this year. The Canadian Utilities Limited, a subsidiary of the International Utilities, will also build a few hundred miles of lines in Alberta. Included are an extenson from Stettler to Edberg and a line from Sexsmith to Wembley, getting power from the plant at Grande Prairie.

BALTIMORE COUNCIL PASSES ELECTRIFICATION ORDINANCE.—After more than a year of negotiation and controversy, the Baltimore City Council has passed three ordinances authorizing the construction of the Pennsylvania Railroad's terminal electrification project, including double-track tunnels and underground transmission. Preliminary work will be undertaken at once, according to George M. Smith, general agent for the railroad in Baltimore. By the electrification of the railroad at least 95 per cent of the existing smoke nuisance is expected to be eliminated.

ALABAMA AND RIVER FALLS POWER COMPANIES COMPETE FOR TERRITORY.—A spirited contest between the Alabama Power Company and the River Falls Power Company as to which shall furnish electric service to Coffee Springs, in the southern part of the state, is forecast in petitions filed by the two companies with the Alabama Public Service Commission. The Alabama Power Company asks for authority to build an elec-

tric transmission line from Enterprise to Coffee Springs, a distance of some 18½ miles. The River Falls Power Company has asked permission to build a transmission line from Samson to Coffee Springs and Bellwood. The Alabama Power Company states that approval has been obtained from city authorities at Coffee Springs. The River Falls company claims that it holds franchises in both towns.

RURAL SERVICE IN DES MOINES DISTRICT GROWS RAPIDLY.—The Des Moines Electric Light Company and the associated Iowa Power & Light Company plan to spend approximately $150,000 this year for the extension of electrical service to more than 400 farms in central Iowa. The improvement program calls for the electrification of about 100 farms in the Des Moines area, 110 farms around Adel, 50 in the Knoxville section, 110 in the vicinity of Oskaloosa and 40 around Colfax. The power plant at Des Moines is now serving about 900 farms, and the demand is increasing rapidly.

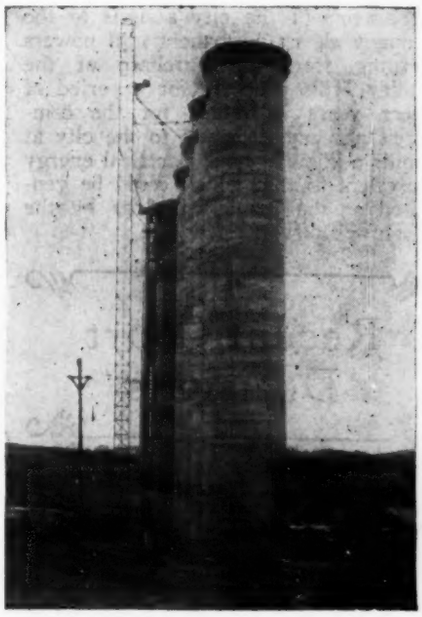
NEW ENGLAND POWER ENGINEERS ELECT OFFICERS.—V. M. F. Tallman was elected chairman of the New England Central Station Association of Power Engineers at the annual meeting of that organization in New Bedford, Mass., June 21, Harry B. Stearns of the New England Power Association, Boston, being secretary and treasurer. Acting in this organization as representatives of the power committee of the New England Division, N.E.L.A., Thomas D. Bond of Charles H. Tenney & Company, Boston, was made chairman and J. H. Jackson of the Public Service Company of New Hampshire, vice-chairman.

REDUCTION IN BROOKLYN RATES FOR LARGE INDUSTRIAL CUSTOMERS. — The New York Public Service Commission has approved a new schedule filed by the Brooklyn Edison Company for large users of power and light. The revision changes the demand charge per kilowatt per month from $2.40 for the first 50 kw. of maximum demand, $2 for next 2,450 kw. of maximum demand and $1.50 for the excess over 2,500 kw. of maximum demand to the following: $2.40 for first 50 kw. of maximum demand, $2 for next 750 kw. of maximum demand and $1.50 for all over 800 kw. of maximum demand. The energy charge remains unchanged.

MOUNTAIN STATES COMPANY TO BUILD ADDITION TO COOS BAY STATION. — A 10,000-kw. addition to the Mountain States Power Company's Coos Bay steam-electric generating plant at North Bend, Ore., is to be started by August 1, and the schedule calls for its completion by July 1, 1930. This addition will increase the capacity of the present station from 5,000 to 15,000 kw. and will, among other purposes, provide standby service over the transmission line which is being built from Dixonville to Marshfield for the interchange of power between the California-Oregon Power Company and the Marshfield division of the Mountain States.

SEATTLE MUST PAY STATE HYDRO TAX.—The city of Seattle, through its license under the federal water-power act in connection with the Skagit River development, is subject to the annual fees imposed in the licensing act passed by the 1929 Legislature, which provides that every person, firm and private or municipal corporation claiming the right to use water for power development shall pay in advance an annual license fee based upon the theoretical water power claimed. The rate is fixed at 10 cents per horsepower up to 1,000 hp., 2 cents per horsepower from 1,000 hp. to 10,000 hp. and 1 cent per horsepower in excess. The act became effective July 1.

Rapid Progress on Saluda Dam in South Carolina



THE great hydro enterprise of the General Gas & Electric Company on the Saluda River near Columbia, S. C., to which reference has frequently been made in the ELECTRICAL WORLD, is being pushed so rapidly that W. S. Barstow, formerly president of that company and now a director of the Associated Gas & Electric system, of which it has become a part, hopes that the plant will be in partial operation this year. The initial equipment of 100,000 hp. is scheduled for completion in the fall of 1930.

Mr. Barstow says that the water of the Saluda River will begin to accumulate in the 41-mile-long basin about August 1, when the valves in the control towers will be closed. With normal rainfall it is expected that the reservoir will be filled up to a height of 200 ft. in eight or nine months. The lake will be 33 miles long, with a shore line of 450 miles and a maximum width of 14 miles. It will cover an area of 76 square miles, or nearly 500,000 acres, and the earth dam, 1½ miles long, 208 ft. high and a quarter of a mile thick at its base, will, it is said, be the largest dam of its kind yet built. The illustration shows the intake towers.

ELKINS, W. VA., WILL TRY TO VALIDATE CITY-PLANT BOND ISSUE.—To meet objections of the Attorney-General of West Virginia to the plan of a bond issue to cover installation of a municipal power and electric light plant at Elkins, the City Council proposes to amend the provisions so as to bring the issue within the law by reducing its amount from $135,000 to $133,000 and equalizing the interest and principal payments. Light and power is now supplied to Elkins by the Monongahela-West Penn Public Service Company. In 1927 the plan for a municipal power plant was carried by the voters.

NORTHERN NEW YORK UTILITIES "MAKES GOOD" ON PROMISED RATE REDUCTIONS.—Forty towns and villages served by the Northern New York Utilities, Inc., received reductions of 25 per cent in their electric rates beginning July 1. This sweeping reduction is the third step in a program announced by Floyd L. Carlisle at a meeting held last November in Watertown, when he said that it was the company's aim to make rates as low as possible. Since that time a reduction of 1 cent per kilowatt-hour to residential and commercial customers has been made as well as one in service charges to rural customers.

MISSISSIPPIANS FOR EDUCATIONAL CAMPAIGN IN INTEREST OF CODE.—An educational campaign in Mississippi to foster the idea of an adequate inspection system designed to enforce the National Electrical Code came before the Mississippi Electric League at its twentieth annual convention held in Jackson last week. President A. H. Jones of McComb, Samuel Adams Chase of the Westinghouse Electric & Manufacturing Company and J. Oliver Emmerich of McComb were among the speakers. E. J. Lenz of Greenville was elected president and F. B. Stern of New Orleans and J. M. Fried of Vicksburg, vice-presidents.

SOUTH GEORGIA COMPANIES PROTEST AGAINST RATE REDUCTIONS.—A vigorous protest against any reduction in rates has been made to the Georgia Public Service Commission by the Savannah Electric & Power Company, the Columbus Electric & Power Company and the South Georgia Power Company of Albany. President H. C. Fess of the Savannah company declared that since 1922 that company had made only between 4 and 6 per cent on its investment of $9,637,000, while the companies at Columbus and Albany, which are

Brief History of the "Electrical World"

The *Electrical World* (published under that name since 1883 and tracing its history back to 1874), is a consolidation of the *Electrical Engineer* (founded in 1882 as the *Electrician*) and the *American Electrician* (founded in 1896). Final consolidation under the title of *Electrical World* took effect on January 1, 1906, the *Electrical World and the Electrical Engineer* having been acquired by the McGraw Publishing Company in 1899 and amalgamated as the *Electrical World and Engineer*, and the *American Electrician*, a McGraw monthly, having been absorbed seven years later.

The roster of past editors of the *Electrical World* includes Carl Hering, Louis Bell, W. D. Weaver, T. C. Martin and many other men prominent in the electrical industry—some, like those named, no longer living, and others, like C. O. Mailloux, A. S. McAllister, Frank F. Fowle, F. M. Feiker, D. H. Braymer and H. V. Bozell, still active in engineering and industrial service. L. W. W. Morrow is now editor and William H. Onken, Jr., senior editor. Allen M. Perry is managing editor. Other members of the present staff are: Earl Whitehorne, contributing editor; G. F. Wittig, statistical editor; H. M. Cameron, associate editor; F. C. Wells, news editor; E. R. Searles, A. E. Knowlton and E. M. Glennon, assistant editors; F. R. Innes, Western editor; H. S. Knowlton, New England editor; Walter C. Heston, Pacific Coast editor, and Paul Wooton, Washington correspondent.

affiliated with the Savannah company, reported earnings of 6.3 per cent in 1928 on a combined valuation of $29,806,211. All of the companies opposed the use of the new Georgia Power Company schedule as a basis for their charges.

HUGE CIRCUIT BREAKER TO BE INSTALLED AT ROSELAND, N. J.—An oil-immersed circuit breaker of unusual size has been ordered from the Westinghouse Electric & Manufacturing Company by the Public Service Electric & Gas Company of New Jersey. The switch will be installed at the Roseland switching station on the Roseland-Bushkill high-tension transmission line now under construction and will be put into operation about October 1. It will stand 25½ ft. high and will be 45 ft. long. The three poles of the switch will be immersed in 22,000 gal. of oil, and its entire weight will be 141 tons.

SUBMARINE CABLES WILL HELP TO SERVE FORD'S LONG BEACH (CALIF.) PLANT.—Two submarine cables to carry 11,000-volt lines will be laid by the Southern California Edison Company in order to fulfill a contract awarded it by the Ford Motor Company for an original installation of 1,000 kw. for its new assembly plant at Long Beach, Calif. Electricity will be delivered to a substation at the new plant at 11,000 volts from two direct circuits from the Edison company's Long Beach steam plant, which is situated only 6,000 ft. from the site of the Ford plant across the Cerritos Channel. The voltage will be reduced at the substation to 2,300 volts for service within the plant. The Edison company has received permission from the War Department to lay the cables, which are to be laid 37 ft. below the low water line.

PEACE NOW REIGNS AT HOLYOKE, MASS.—An agreement ending the controversy which had raged since 1925 between the municipal gas and electric department of Holyoke, Mass., and the Holyoke Water Power Company was signed last week, and the city's suit against the company will be discontinued. By one of the chief clauses in the agreement the city assigns to the company eleven permanent mill powers accruing from the purchase of the Hadley Mills property for a period of fifteen years in return for the company's agreement to sell to the city at 3 mills a kilowatt-hour electrical energy equivalent to that which could be generated at the municipal plant by the eleven mill powers.

Recent Court Decisions

WIND AND STORM AS SOLE CAUSE OF INJURY URGED AS AGAINST DOCTRINE OF RES IPSA LOQUITUR.—The United States Circuit Court of Appeals in Montana held, in Houle vs. Helena Gas & Electric Light Company, that in a damage action for injuries to a child who came into contact with a heavily charged electric wire which had broken and fallen on the sidewalk, a prima facie case under the doctrine of *res ipsa loquitur* ("the thing speaks for itself") could not be overcome by showing as a matter of law that wind and storm were the sole and only cause of the accident. The question was for the jury under the evidence. A directed verdict for the defendant was therefore reversed. (31 Fed. [2d] 67.1.)*

PERMISSION TO APPROVE ACQUISITION OF ONE UTILITY COMPANY BY ANOTHER WRONGLY BASED ON SELECTMEN'S ACTION.—The Supreme Court of New Hampshire has found that the New Hampshire Public Service Commission should not have based its approval of a petition by the Baker River Light & Power Company to acquire utility property of Fox & Putnam on the ground that the selectmen of towns affected would refuse to grant to another company (the Parker-Young Company) filing a similar petition the right to maintain poles and structures in the highways. The court has also decided that evidence of substantial difference in the respective rates of the two companies should have been received. The decision of the commission was, therefore, on suit to annul it being brought, overruled and a rehearing ordered. (145 At. 786.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

NEBRASKA REGULATIONS FOR CARRYING POWER WIRES ACROSS RAILROADS.—Following an investigation, the Nebraska State Railway Commission has issued a general order that in the future wire companies may have, as in the past, the option of carrying their wires over railroad crossings or using an underground conduit, but that in the case of power companies the conduit must occupy the full width of the railroad right-of-way.

VALUE OF UTILITY BUSINESS PROPERTY HELD NOT TO DEPEND UPON ITS INCOME.—In fixing the compensation to be paid to the Southern California Edison Company for the taking by the city of Los Angeles of its electric distribution system and franchise rights at $845,000 plus severance damages of $20,000—a judgment sustained by the California Supreme Court, as recorded in the ELECTRICAL WORLD for May 25, page 1073—the California Railroad Commission refused to sanction the theory advanced by the company that the value of a utility business property depends upon and should be measured by its income and sanctioned the position of the city that the value to be fixed should be obtained by finding a figure of reproduction cost new less depreciation, to which should be added going value and severance value. The company's figure under its method of computation was $3,166,960; the city's figure was $717,129. The commission said in part: "The income theory advocated by the company in substance has been advanced in other proceedings before this commission and has not been adopted. As a measure of value it has been considered too unstable. It is based upon adopted constants which are in fact variables. It assumes for the indefinite future that this commission will not change the rate of return; that the net return, the losses and the risks incurred will remain the same; that there will be a definite future program of building with depreciation charges and prices remaining the same; that future cost of financing will follow the present; that there will be a certain future population; that no other form or mode of heat, light or power will transplant, modify or compete differently with the present electric service; that certain estimated but unknown revenues and operating and maintenance expenses will accrue, and that many other intangible things will come to be realities. The whole structure is built upon the amount of net earning per meter, which is estimated. The only definitely known figure underlying net earnings is the average gross revenue per meter per year for one year. . . . Surely enough has been said to indicate that the theory advanced by the company is not a method of arriving at value and damages for taking, but in reality is a means of estimate by which a value is put upon the property with the business attached which would wholly consume and render the property more than useless to any possible purchaser. It is a form of shadow boxing with the future potentialities of this property which cannot be considered seriously for the purposes of this proceeding. This is not saying, however, that the facts surrounding this property from the standpoint of income should not be seriously considered. Such facts will be considered," the commission declared, "along with the other factors that form a basis for discovering value."

News About Men of the Industry

C. F. Scott Elected to Honorary Membership in Institute

Charles F. Scott, head of the electrical engineering department of Yale University, who was elected an honorary member of the American Institute of Electrical Engineers, as announced in the June 29 issue of the ELECTRICAL WORLD, has by no means confined his activities to academic circles since entering upon his engineering career. He is a past-president of the American Institute of Electrical Engineers and of the Society for the Promotion of Engineering Education, not to mention the membership he holds in other scientific organizations. Following graduation from Ohio State University and subsequent post-graduate work at Johns Hopkins University he entered the employ of the Westinghouse Electric & Manufacturing Company in 1888 in the testing department, going from there to the laboratory, where he assisted Nikola Tesla in his work on alternating-current motors. Subsequently he served as assistant electrical engineer, chief electrical engineer and later consulting engineer for the company. It was in 1911 that he took the chair of electrical engineering at Yale University, the position he occupies at the present time.

Sir Felix Pole Heads British Electrical Enterprises

Sir Felix Pole, who has been connected with the Great Western Railway for the past 38 years, and for some years as general manager, is resigning this position to succeed Howard Levis as chairman of the Associated Electrical Industries. This is a big holding company which was recently formed to control Metropolitan-Vickers Electrical, British Thomson-Houston, Edison Swan and Ferguson Pailin. A large interest in the company is held by the International General Electric Company in New York. The steps taken to merge these companies, said Mr. Levis at the meeting in May, could be regarded only as the beginning of what should be done if the electrical industry in England was to develop successfully, and every effort, he thought, should be made by those in control of the industry to secure cooperative arrangements which would give an adequate return. Sir Felix Pole's appointment to the chairmanship, after so many years' association with the Great Western Railway, is of considerable interest at the present time, when important schemes of electrification are said to be in contemplation. Sir Felix will retain his connection with the Great Western Railway in a consultative capacity.

B. C. Cobb Elected President Penn-Ohio Company

B. C. Cobb has been elected president of the Penn-Ohio Edison Company to succeed R. P. Stevens, who resigned to become president of the Niagara Hudson Power Corporation, recently organized. Mr. Cobb is also president of the Commonwealth Power Corporation and chairman of the board of the Allied Power & Light Corporation and of the Commonwealth & Southern Corporation.

ROBERT F. BURNETT, for the past eleven years general manager of the Peoples Gas & Electric Company, Oswego, N. Y., has been appointed manager of the South County Public Service Company, Westerly, R. I., and the Mystic (Conn.) Power Company, succeeding W. C. Clarke.

WALTER ROBBINS has been named chairman of the board of directors of the General Cable Corporation, New York, to succeed J. W. Marsh, resigned. H. T. DYETT was elected president to succeed Mr. Robbins and Mr. Marsh became vice-chairman of the board.

G. H. Howard Assumes New Executive Duties

George H. Howard, president of the United Corporation, has been named chairman of the executive committee of the Niagara Hudson Power Corporation. Mr. Howard is a native of Craftsbury, Vt., and a graduate of Dartmouth College and the Harvard Law School. Following graduation he became identified with Simpson, Thacher & Bartlett, lawyers of New York, and seven years later was made a member of the firm. During this connection Mr. Howard devoted practically all his time to work in connection with public utilities, and when he withdrew in the spring of this year he became president of the United Corporation. Mr. Howard is a director of the United Corporation, a director and member of the executive committee of the United Gas Improvement Company, a director and member of the executive committee of the Mohawk-Hudson Power Company and of other enterprises.

Ray P. Stevens Heads New Holding Company

Ray P. Stevens, president of the Allied Power & Light Corporation, has been named president of the Niagara Hudson Power Corporation, recently organized from the merger of the Buffalo, Niagara & Eastern Power Corporation, the Northeastern Power Corporation and the Mohawk-Hudson Power Corporation. Mr. Stevens has for many years been active in the operation and management of public utility properties in various sections of the country and last year, when the Allied Power & Light Corporation was formed from the consolidation of Hodenpyl, Hardy & Company, Inc., and Stevens & Wood, he became president of the new organization, after having served as chairman of the board of Stevens & Wood.

His early experience was obtained in the South, central New York and in Pennsylvania. After successfully effecting a consolidation of eighteen light and power companies in Allentown he became president of the combined properties, subsequently resigning to transfer his interests to Ohio. Mr. Stevens has devoted considerable time to association work, having served as president of the American Electric Railway Association and as a member of the American Institute of Electrical Engineers, the American Society of Mechanical Engineers and of other technical organizations.

J. E. Fredericks Directs Associated Construction Work

J. E. Fredericks, vice-president of the Lexington Water Power Company, a subsidiary of the General Gas & Electric Corporation, and now a part of the Associated Gas & Electric System, has been transferred from Columbia, S. C., to headquarters in Binghamton, N. Y. Mr. Fredericks has been given the supervision of all outside engineering and construction work for the Associated Gas & Electric Company on all of its properties. He has been with W. S. Barstow & Company, the builders of the Saluda River development, for the last fifteen years, and during that time has been engaged in the engineering construction operation on all of the properties of this corporation. He has been in the South Carolina territory since 1924.

Following graduation from Cornell University he began work with Westing-

house, Church, Kerr & Company. He remained with this company for about 1½ years, and during that time was engaged in the electrification of the Pennsylvania Railroad in the vicinity of New York. For five years Mr. Fredericks was connected with the J. G. White Company, now the management company of the Associated Gas & Electric Company. During this connection he was engaged in various activities in the electrical field in Canada, Delaware, Tennessee, Georgia, South Carolina and New York.

A. P. SINGER, superintendent of power of the Memphis Power & Light Company, Memphis, Tenn., has resigned to establish a residence in Scotland. ROBERT BRUCE, chief operating engineer, has been selected to succeed Mr. Singer. Mr. Bruce has been identified with the Memphis properties since 1918.

J. FRED HULL of Maryville, Mo., was sworn in June 4 as a member of the Missouri Public Service Commission. He has been appointed for a six-year term, to end on April 15, 1935, and succeeds J. P. Painter of Milan, Mo. Mr. Hull served as a member of the Missouri Constitutional Convention in 1922.

HAROLD R. HENDERSON has been appointed advertising manager of the Brooklyn Edison Company to succeed the late Fred B. Pitney. Mr. Henderson has been a member of the Brooklyn Edison advertising department since 1924 and has been assistant advertising manager for the last three years. Before coming to Brooklyn he served for five years as advertising manager of the New Bedford Gas & Edison Light Company, New Bedford, Mass.

EDWARD R. BERRY, consulting engineer for the General Electric Company, West Lynn, Mass., has been elected vice-president and a director of Inland Utilities, Inc., formed recently to acquire certain properties in Pennsylvania and West Virginia. A graduate of the University of Maine, Dr. Berry has to his credit many patents on electrical, mechanical and chemical subjects. He is a member of the American Institute of Electrical Engineers, the American Electrochemical Society and of other similar organizations.

D. H. REDINGER, who has been resident engineer on the Big Creek-San Joaquin River hydro-electric project of the Southern California Edison Company, has brought the construction phase of the work to a close and is to be transferred July 1 to the operating department, where he will become superintendent of the Big Creek division, in full charge of the company's property in that division. G. C. HECKMAN, who was in charge of the electrical construction work under Mr. Redinger, will become assistant superintendent of the division in charge of maintenance and R. B. LAWTON, assistant superintendent in charge of operation.

Kenney Named for Another Executive Position

T. A. Kenney, who is identified with several utility companies in an executive capacity, has been elected a vice-president of the Penn-Ohio Edison Company. Mr. Kenney became identified with Hodenpyl, Hardy & Company in 1912 and when last year these interests consolidated with Stevens & Wood, Inc., to form the Allied Power & Light Corporation he became a vice-president and director. At present he is also a vice-president and a director of the Commonwealth Power Corporation. Mr. Kenney has been active in association activities, having devoted considerable time to committee work for the National Electric Light Association and for the American Electric Railway Association.

P. M. Parry Vice-President of Salt Lake Utility

P. M. Parry, commercial manager for the Utah Power & Light Company, Salt Lake City, since 1920, has been elected vice-president and commercial manager of that company. Mr. Parry's connection with the Utah Power & Light organization dates back to its very beginnings, he having made his début in the electrical industry in 1904 when he entered the employ of the Utah Light & Railway Company at Ogden. In 1911 be became treasurer of the Merchants Light & Power Company and remained in that position until the latter part of 1912, when that organization was included in the consolidation of a number of companies to form the Utah Power & Light Company.

COLONEL L. W. CALL, who has served as chief counsel of the Federal Power Commission since the approval of the water-power act, June, 1920, has reached the retirement age and will be relieved on July 1. His successor has not been named.

J. WEST has been appointed a member of the Indiana Public Service Commission and John W. McCardle has been reappointed, according to an announcement made by Gov. Harry G. Leslie. Mr. West will succeed Harvey Harmon of Princeton. At a reorganization meeting, Mr. McCardle was elected chairman to succeed Frank T. Singleton of Martinsville. Mr. McCardle's appointment marks the beginning of his thirteenth year as a member of the commission. He was chairman from 1921 to 1926. Mr. West retired from the Circuit Court at Crawfordsville January 1 after 31 years as judge.

DENIS STAIRS of the Montreal Engineering Company has been appointed manager of the Nova Scotia Light & Power Company, Halifax, N. S., to succeed the late J. F. Lumsden. Mr. Stairs is a director of the Nova Scotia Light & Power Company.

GEORGE E. FULLER has been appointed commercial manager of the Worcester (Mass.) Electric Light Company, effective July 1. Mr. Fuller has been office manager of the company for the past seven years and two years ago was invested with the title of vice-president. He has been assistant treasurer of this organization and has long been in close touch with its personnel, business development and territorial obligations.

Obituary

W. S. Andrews

William Symes Andrews, electrical engineer and early associate of Thomas A. Edison, died at his home in Schenectady, N. Y., July 1 in his eighty-second year, the golden jubilee year of his connection with the electrical industry and the jubilee year of Mr. Edison's incandescent lamp. It was in November, 1879, that he entered the employ of Mr. Edison at Menlo Park, N. J., assisting in winding the armature of Edison's first dynamo and in other experimental work in which Mr. Edison and his associates were engaged. In 1881 Mr. Andrews was made superintendent of the testing department at the Edison Machine Works, New York. Less than two years later he was appointed chief electrical engineer of the central-station construction department of the Edison Electric Light Company and in this capacity established more than thirty generating stations within three years. After various activities he removed to Schenectady to enter the employ of the General Electric Company, where he started his investigations on the X-ray. At the time of his death he was connected with the General Electric organization in a consulting capacity. He was a fellow of the A.I.E.E. and of the Illuminating Engineering Society and a member of the American Association for the Advancement of Science, the Franklin Institute of Philadelphia and of other societies.

N. MCLEAN SEABREASE, a director of the Appalachian Electric Power Company, died in the Chestnut. Hill Hospital, Philadelphia, June 30, after an operation. Mr. Seabrease was born in Rochester, Minn., July 18, 1872, and was educated at the University of the South, Sewanee, Tenn.

Financial and Statistical News

LIGHT AND POWER security issues for the first six months total $583,400,000. June security issues aggregated $65,544,500. January yield, 5.28; May, 5.93; June, 5.96. Utilities advance steadily on stock market under stimulus of good business reports. High money rate at end of week calls halt temporarily.

——ELECTRIC BOND & SHARE offers $66,562,000 in rights to present stockholders to provide the company with $145,000,000 of additional capital.

——RECORD PEAKS REACHED by Allied Power & Light, Middle West Utilities, United Gas Improvement, Commonwealth Edison and Niagara Hudson warrants. Rumors of mergers and consolidations continue.

——SEASONAL SLACKENING IN UTILITY FINANCING OCCURS, but stocks continue active and there is little prospect of the usual July stringency.

——TRANSACTIONS ON NEW YORK EXCHANGE aggregate 537,865,790 shares for first six months. The Curb turnover was 207,882,034 shares. Trading in June heaviest on record. Public utilities outstanding leaders in stock movements.

April Customer Ownership Sales $7,470,000

April sales of electric light and power company stock to customers, employees and other local parties show a slight increase compared with the two previous months. On the basis of monthly reports received by the ELECTRICAL WORLD it is estimated that sales during the month amounted to $7,470,000, the number of shares sold was 103,350, and the number of transactions 12,350.

There was less activity in the first four months of this year than last, sales being $34,825,000 in 1929 and $56,390,000 in the corresponding period of 1928. The average price per share was higher in April of this year than a year ago, showing a larger proportion of shares in the $100 class. Over $6,000,000 of the whole value was in the form of shares averaging around $100, the balance in low-priced stock.

Steady Rise in British Electricity Consumption

Returns recently rendered to the British Electricity Commissioners show that the amount of current sold to consumers by authorized undertakers in the United Kingdom in the year ended December 31, 1928, was 7,602,000,000 kw.-hr., representing an increase of 752,000,000 kw.-hr., or about 10.9 per cent on the figure for the previous year.

Comparative figures for the period 1922 to 1928 are set out in the accompanying table. They represent the amount of current retailed direct to consumers and are exclusive of intersales in bulk between authorized undertakers.

Year	Kw.-Hr. Sold to Consumers	Increase on Previous Year Actual	Per Cent
1922	3,645,000,000	....	....
1923	4,339,000,000	694	19.0
1924	4,998,000,000	659	15.2
1925	5,515,000,000	517	10.3
1926	5,724,000,000	209	3.8
1927	6.850,000,000	1,126	19.6
1928	7,602,000,000	752	10.9

Over a period of six years since 1922 the annual sales of electricity to consumers by authorized undertakers in Great Britain have thus increased at an average rate of about 660,000,000 kw.-hr. per annum.

Electric Bond & Share Offers Shareholders Rights

Stockholders of the Electric Bond & Share Company of record of July 15 are being offered rights worth approximately $66,562,000 at present market levels. Announcement of the offering followed the approval by the directors of the offering of one share of common stock at $85 a share for each six shares of common stock owned. Proceeds of this financing will give the company $145,000,000 additional funds. There will be about 10,240,300 shares of common stock of the company outstanding on July 15, and the rights will call for the issuance of about 1,706,716 additional common shares. The rights will expire August 20.

The present company resulted from the consolidation of the former Electric Bond & Share Company and the Electric Bond & Share Securities Corporation, with an authorized capitalization of 1,000,000 shares of cumulative $6 preferred stock, 1,000,000 shares of cumulative $5 preferred stock, and 12,500,000 shares of common stock, all without par value. Including the issuance of 144,229 shares in payment of the stock dividend distributable on July 15 and the issuance of 480,765 shares for sale to officers and other employees, there will be outstanding at the close of business on July 15 about 10,240,300 common shares. With the offering of 1,706,716 additional shares, 11,947,016 of the 12,500,000 authorized common shares will be outstanding. There are 750,000 shares of $6 preferred stock outstanding, while none of the $5 preferred shares has been issued. There is no funded debt.

Crocker-Wheeler Declares Accumulated Dividends

At a recent meeting the directors of the Crocker-Wheeler Electric Manufacturing Company have declared the regular quarterly dividend of $1.75 on the preferred stock, payable July 15 to holders of record July 5. The directors have also declared a dividend of $2 on account of accumulated dividends on the preferred stock, payable August 1 to holders of record July 2. This reduces accumulations on the preferred stock to 10 per cent.

Recent Listings

It is announced that the New York Stock Exchange has authorized the listing on or after July 1 of not exceeding 4,522 additional shares of common stock (par $15) of the Federal Light & Traction Company, on official notice of issuance as a stock dividend, making the total amount applied for 456,697 shares of common stock. There have also been authorized for listing 131,378 additional shares of common stock of the North American Company on official notice of issuance of a stock dividend. Recent authorization was given for the listing of 508,120 shares of cumulative preferred stock without par value of the United Gas Improvement Company and 20,324,835 shares of common stock without par value.

ANACONDA STOCK ON $7 BASIS.—At a meeting of the directors of the Anaconda Copper Mining Company outstanding capital stock of the company was placed on a dividend basis of $7 for the year, or $1.75 for the quarter. The same rate was paid to capital shareholders before the recent increase of 2,165,011 shares. Rights to subscribe to two new shares were offere l to stockholders for every five previously held at a price of $55 each.

ELECTRIC HOUSEHOLD UTILITIES CORPORATION DECLARES STOCK DIVIDEND.—Directors of the Electric Household Utilities Corporation have declared a stock dividend of 1¼ per cent and the regular quarterly dividend of 25 cents, both payable July 20 to holders of record July 5. A similar stock dividend was paid April 25 last. J. H. Briggs has been elected a director, succeeding

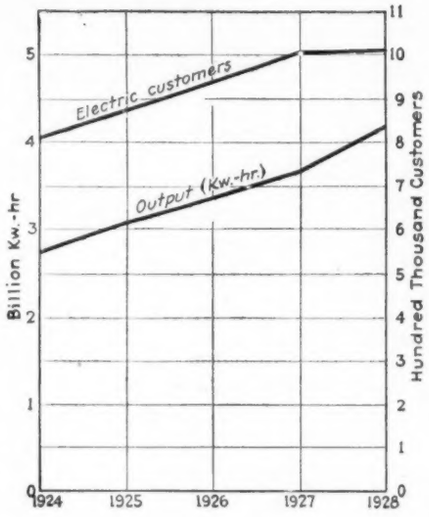
the late E. F. Carry, and Richard G. Chamberlain has been elected vice-president in charge of the western division

INTERNATIONAL HYDRO-ELECTRIC DECLARES FIRST DIVIDEND ON "A" STOCK.—The board of directors of the International Hydro-Electric System, a division of the International Paper & Power Company, has declared as the first quarterly dividend on the class A stock a stock dividend at the rate of one-fiftieth of a share for each share held. The dividend is payable July 15 to shareholders of record at the close of business June 25. Any shareholder, if he so elects, may receive in lieu of the stock to which he is entitled on this dividend, cash at the rate of 50 cents for each one-fiftieth of a share of class A stock deliverable on this dividend.

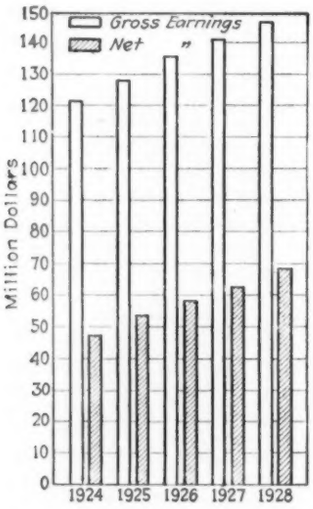
PACIFIC GAS & ELECTRIC STOCKHOLDERS EXCEED 53,000.—Ownership of the Pacific Gas & Electric Company is distributed among 53,197 stockholders, of which 33,157 are preferred and 20,040 are common. Residents of California represent 81 per cent of the company's stockholders.

Standard Gas & Electric Assets Exceed $1,054,000,000

THE Standard Gas & Electric Company and subsidiary and affiliated companies closed 1928 with combined assets of more than $1,054,000,000, it is revealed in the balance sheet as of Dec. 31, made public in the annual report. Consolidated earnings for the year showed a balance equal to $6.57 a share on the common stock, as compared with $5.83 a share for 1927. Collectible earnings of the company for 1928 showed a balance equal to $4.85 a share on the common stock, as compared with $4.68 a share for the previous year. John J. O'Brien, president, credits the successful results for 1928 to improved efficiency at the subsidiary and affiliated public utility properties, despite numerous rate reductions. "During 1928," he states in his remarks to the stockholders, "rate reductions totaling approximately $4,820,000 annually in savings to customers of the subsidiary and affiliated public utility companies were placed in effect or announced for the near future. These rate reductions represent the effect of operating economies and advantageous financing. Inasmuch as rate changes occurred at various times throughout the year, their effect is not fully reflected in 1928 operations. A substantial stimulation of the sale of energy is expected to follow these changes."



Operating Statistics Covering Five-Year Period



Standard Gas & Electric Earnings Since 1924

At the close of the year the company's system served 1,514 cities and towns having estimated population in excess of 6,000,000, eighty communities having been added during the year. As of Dec. 31, 1928, a total of 1,529,617 customers of all classes were served, an increase of 4.91 per cent. Electric connected load, or business served, increased 9.97 per cent to 2,825,452 kw. Electric energy output for 1928 amounted to 4,137,752,254 kw.-hr., an increase of 12.70 per cent. The sale of domestic electric and gas appliances and the continued development of new business added a large amount of revenue-producing load to the system's lines.

Net construction expenditures of the subsidiary and affiliated public utility companies during 1928 totaled $33,198,116. Electric generating capacity aggregating 214,148 kw. was added, of which 201,530 kw. represents capacity added by new construction and 12,618 kw. through acquisition of properties. The 1929 construction budget is estimated at $55,822,350, of which $39,011,390 is for new projects, while $16,810,960 is for completion of work started prior to Jan. 1, 1929.

The approximate number of shareholders of the subsidiary and affiliated companies at the close of the year was 148,000, of which the customer shareholders are estimated to exceed 118,000. In addition to the shareholders of the subsidiary and affiliated companies, Standard Gas & Electric Company had more than 43,000 shareholders at the close of the year.

Standard Gas & Electric Company	1928	1927
Gross earnings	$13,291,763	$13,124,131
Net earnings	13,149,526	12,881,008
Interest and discounts	2,441,306	2,605,998
Balance	10,708,220	10,275,010
Surplus after dividends	1,922,911	2,258,592
California Oregon Power Company		
Gross earnings	3,384,862	2,913,081
Expenses and taxes	1,177,394	1,125,841
Net earnings	2,207,468	1,787,240
Interest charges	772,769	668,074
Preferred dividends	463,686	354,727
Balance for depreciation, amortization, common dividends and surplus	1,003,198	770,641
Louisville Gas & Electric Company and Subsidiaries		
Gross earnings	$9,685,999	$8,817,923
Expenses and taxes	4,696,295	4,264,956
Net earnings	4,989,704	4,552,966
Interest charges	1,318,573	1,148,250
Preferred dividends	1,364,877	1,307,830
Balance for depreciation, amortization, common dividends and surplus	2,628,729	2,277,267
Mountain States Power Company		
Gross earnings	$2,997,296	$2,748,174
Expenses and taxes	1,822,883	1,715,119
Net earnings	1,174,413	1,033,054
Interest charges	649,703	682,638
Preferred dividends	356,826	317,911
Balance for depreciation, amortization, common dividends and surplus	246,385	204,232
Northern States Power Company and Subsidiaries		
Gross earnings	$31,339,721	$29,803,158
Expenses and taxes	15,242,341	14,710,990
Net earnings	16,097,380	15,092,168
Interest charges	5,577,919	5,906,616
Preferred dividends	4,739,735	4,221,825
Balance for depreciation, amortization, dividends and surplus	6,352,598	5,024,576
Oklahoma Gas & Electric Company		
Gross earnings	$12,003,353	$9,791,816
Expenses and taxes	6,301,272	5,163,387
Net earnings	5,702,081	4,628,429
Interest charges	1,971,255	1,988,095
Preferred dividends	1,326,301	1,079,332
Balance for depreciation, amortization, common dividends and surplus	3,152,545	2,456,356
San Diego Consolidated Gas & Electric Company		
Gross earnings	$6,834,773	$6,564,213
Expenses and taxes	3,632,989	3,496,898
Net earnings	3,201,784	3,067,315
Interest charges	702,708	692,798
Preferred dividends	440,475	440,475
Balance for depreciation, amortization, common dividends and surplus	2,061,469	1,939,087
Southern Colorado Power Company		
Gross earnings	$2,290,899	$2,327,653
Expenses and taxes	1,217,837	1,310,318
Net earnings	1,073,062	1,017,335
Interest charges	432,561	433,185
Preferred dividends	297,866	293,061
Balance for depreciation, common dividends and surplus	350,183	304,262
Standard Power & Light Corporation and Subsidiaries		
Gross earnings	$71,742,617	$71,070,494
Expenses and taxes	41,917,252	42,974,095
Net earnings	32,044,954	30,325,696
Interest and dividend charges	15,184,775	13,226,155
Depreciation, amortization, etc	7,880,894	8,029,156
Balance	2,978,560	3,095,035

Current Earnings Reports of Electric Light and Power Companies

	1929	1928	Per Cent Increase	Operating Ratio 1929	Operating Ratio 1928
American Water Works & Electric & Subs. (Year ended May 31)					
Gross earnings	$52,007,417	$49,600,816	4.8	50	52
Net earnings	25,736,892	23,457,400	9.6	..	..
Cities Service (Year ended May 31)					
Gross earnings	37,618,672	33,074,373	13.7	..	..
Net earnings	36,423,179	31,954,770	14.0	..	..
Commonwealth Power Subs. (Year ended May 31)					
Gross earnings	61,073,872	55,158,163	10.8	51	53
Net earnings	29,688,049	25,989,124	14.2	..	..
Consumers Power (Year ended May 31)					
Gross earnings	32,151,668	28,094,454	14.5	49	51
Net earnings	16,311,147	13,777,562	18.5	..	..
Detroit Edison (Year ended May 31)					
Total revenue	54,855,230	49,225,178	11.4	65	66
Gross corporate income	19,170,095	16,578,800	15.6	..	..
Kansas City Power & Light (Year ended May 31)					
Gross earnings	14,162,195	13,229,182	7.0	51	51
Net earnings	6,924,641	6,451,733	7.3	..	..
Nevada-California Electric & Subs. (Year ended May 31)					
Gross earnings	5,458,982	5,367,323	1.7	46	43
Net earnings	2,963,086	3,027,458	2.1	..	..
Penn-Ohio Edison & Subs. (Year ended May 31)					
Gross earnings	28,589,018	26,695,583	7.1	60	62
Net earnings	11,517,115	10,020,746	14.9	..	..
Tennessee Electric Power & Subs. (Year ended May 31)					
Gross earnings	13,811,266	12,834,133	7.5	51	54
Net earnings	6,760,704	5,862,832	15.3	..	..

Utility Financing Totals $583,400,000

Electric Light and Power Offerings During First Six Months Below Last Year's Record

NEW stock, bond and note offerings by the electric light and power companies of the country during the first six months of 1929 amounted to $583,400,000, as compared with $756,390,852 for the similar period of 1928, a decrease of 29.6 per cent. January ushered in the present year with a total of $79,865,000 and was followed in February and March by the substantial totals of $162,045,000 and $174,270,500 respectively. A decline set in during April, when the meager sum of $29,865,000 was recorded. An upward spurt occurred in May to the $71,810,000 mark and June brought the first half year to a close with a total of $65,544,500. In addition to the public offerings made, the electric light and power companies during the six-month period issued rights to the amount of $205,492,429.

Attention is called to the prominent part taken by preferred issues in June, five offerings of this type appearing among the new flotations. The average yield on the June offerings reached the 5.96 per cent mark.

New Security Issues of Electric Service Companies in June

Name of Company	Amount of Issue (Par Value)	Period, Years	Class	Purpose	Interest Rate	Price	Per Cent Yield
Central Maine Power Co.	$1,500,000	26	First and general mortgage gold bonds, series D	To reimburse the company in part for the cost of additions and extensions made to its property	5	99½	5.03
Columbus Electric & Power Co.	2,000,000	..	Cumulative preferred stock, series D	To retire maturing notes	6	100	6
Keystone Water Works & Elec. Corp.	2,200,000	10	Convertible gold debentures, series B	To acquire certain bonds, to reimburse for indebtedness incurred in connection with extensions and additions to properties of subsidiaries and for other corporate purposes	6	97½	6.35
Penn. Central Light & Power Co.	2,000,000	50	First mortgage gold bonds	To reimburse the company in part for moneys expended for the acquisition of new properties and for additions and extensions	5	99	5.05
Texas-Louisiana Power Co.	1,600,000	17	First mortgage gold bonds, series A	To reimburse the company in part for construction expenditures, for the acquisition of properties and for other corporate purposes	6	97½	6.25
Central States Electric Corp.	10,000,000	..	Convertible preferred stock	To liquidate current indebtedness, to acquire additional investments and for other corporate purposes	6	100	6
Southern Public Utilities Co.	8,000,000	14	First and refunding mortgage gold bonds	To reimburse the company in part for capital expenditures	5	100½	4.95
General Gas & Electric Corp.	23,750,000	..	Cumulative convertible preferred stock		6	95	6.30
United Public Utilities Co.	1,000,000	1	Gold notes	To reimburse for additions and improvements already made and for other corporate purposes	6	99	7.05
General Water Works & Electric Corp.	2,942,500	..	Common stock, class A	For the acquisition of additional subsidiaries to reimburse the corporation for expenditures on additions and betterments and for other corporate purposes.	..	26¼	....
Intercontinents Power Co.	1,485,000	..	Cumulative preferred stock	To raise funds for the purchase of additional properties and for other capital expenditures	7	99	7.07
Utilities Power & Light Corp.	250,000 sh. (not included in total)	..	Common stock		..	..	....
Western Power, Light & Telephone Co.	1,187,000	19	First lien collateral gold bonds, series A	To reimburse company for cost of new properties, additions and extensions and for other corporate purposes	6	97½	6.20
New England Public Service Co.	3,880,000	..	Convertible preferred stock		6	97	6.18
El Paso Electric Co.	4,000,000	21	First mortgage gold bonds, series A	To retire present floating debt and to finance major portion of company's construction program	5	95	5.40
Total	$65,544,500			Rights	$58,557,621		
Total amount actually realized	63,903,575			Total financing for June	$122,461,196		

Business News and Market Conditions

April Exports Up 42 per Cent

Exports of electrical equipment for April show an increase of 42 per cent over the total for the same month last year. The total for April, 1929, was $12,221,805, as against $8,605,820 for April of last year. While the largest single monthly increase this year to date, the figure shows the trend, which is substantially higher than for any previous years, considering the value of the dollar.

The largest single importer was Canada, with imports of $3,346,458, or more than 27 per cent of the total.

The most important increases over April of last year were in generators, transmission and distribution apparatus and motors. There was also a very large increase in the exports of refrigerators.

Metal Markets Lethargic

Open-market domestic sales of copper during the last week are in smaller volume than for any corresponding period since May 22. Some factors interpret this inactivity as "the lull that precedes a storm (of buying)." In other directions a somewhat less optimistic viewpoint is taken. Custom smelters continue to take most of the business and prices are unchanged at the 18-cent Connecticut Valley basis.

NEW YORK METAL MARKET PRICES

	June 26, 1929 Cents per Pound	July 3, 1929 Cents per Pound
Copper, electrolytic	18	18
Lead, Am. S. & R. price	7.00	7.00
Antimony	8.75	8.625
Nickel, ingot	35	35
Zinc, spot	7.075	7.05
Tin, Straits	44.50	45.125
Aluminum, 99 per cent	24.30	24.30

Base copper wire price July 3, 1929, 19½ cents.

Value and Destination of Electrical Exports for April

(Issued by Bureau of Foreign and Domestic Commerce)

Article	April 1928	April 1929
Generators:		
Direct current—		
Under 500 kw.	$99,250	$111,041
500 kw. and over	31,486	39,333
Alternating current—		
Under 2,000 kva.	7,998	16,633
2,000 kva. and over	.....	.....
Steam turbine generator sets	72,710	20,074
Accessories and parts for generators	68,953	48,438
Self-contained lighting outfits	65,890	93,712
Batteries:		
Flashlight batteries	222,182	378,673
Other dry and wet cell primary batteries	292,418	.....
Radio B and C batteries (dry)	.....	71,439
Other, not elsewhere specified	.....	171,840
Storage batteries	344,485	341,817
Transforming or converting apparatus:		
Power transformers, 500 kva and over	17,342	50,352
Distribution transformers, less than 500 kva	101,716	109,953
Instrument transformers	22,725	17,240
Other transformers, n.e.s.	56,410	87,054
Complete battery chargers under 15 amps	14,817	18,144
Rectifiers, double current and motor generators, dynamotors, synchronous, and other converters	166,438	63,972
Transmission and distribution apparatus:		
Switchboard panels, except telephone	264,349	84,665
Switches and circuit breakers over 10 amps	111,190	171,168
Fuses and fuse blocks	30,358	40,188
Watt-hour and other measuring meters	123,608	121,008
Recording, indicating, etc. apparatus—		
Electrical indicating instruments	29,169	53,098
Electrical recording instruments	24,850	21,939
Other electrical testing apparatus	54,266	71,065
Lightning arresters, choke coils, reactors and other protective devices	54,962	126,330
Motors, starters and controllers:		
Motors, ¼ hp. and under	$169,493	$207,643
Motors, over ¼ and under 1 hp.	95,279	93,335
Stationary motors—		
1 to 200 hp.	219,144	417,561
Over 200 hp.	18,286	17,368
Railway motors	30,377	4,829
Electric locomotives—		
Railway	40,505	3,600
Mining and industrial	20,859	44,351
Station and warehouse electric motor trucks	15,924	18,610
Starting and controlling equipment—		
For industrial motors	116,485	197,758
For electric railway and vehicle motors	5,486	1,300
Portable electric tools—		
Portable electric tools, except automotive	117,190	88,703
Automotive electric machine tools	.....	10,497
Accessories and parts for motors	174,731	274,930
Electric appliances:		
Electric fans	63,835	109,859
Electric lamps—		
Metal filament	154,768	93,176
Other electric lamps	28,462	40,718
Flashlights	229,343	285,888
Searchlights and projectors	52,825	42,157
Motor-driven household devices—		
Electric household washing machines	138,300	233,075
Electric vacuum cleaners	106,509	67,402
Other motor-driven devices, except tools	73,279	124,552
Electric flatirons	27,015	38,637
Domestic heating and cooking devices—		
Electric cooking ranges	26,779	29,890
Other domestic heating and cooking devices	68,689	80,778
Industrial electric furnaces and ovens	20,420	27,897
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, etc	165,396	174,522
Signal and communication devices:		
Radio apparatus	$711,984	$999,348
Telegraph and telephone apparatus	300,178	585,102
Railway signals, switches, and attachments	59,167	39,407
Bells, buzzers, annunciators and alarms	68,148	27,345
Other electric apparatus:		
Spark plugs, magnetos, and other ignition apparatus—		
Spark plugs	96,151	214,192
Other starting, lighting, and ignition equipment	106,838	215,102
Insulating material	79,030	108,343
Metal conduit, outlet and switch boxes	104,105	111,496
Sockets, receptacles, and lighting switches	147,553	183,400
Electric interior lighting fixtures	160,207	231,950
Electric street lighting fixtures	22,104	54,559
Other wiring supplies and line material	72,818	92,246
Other electrical apparatus, not elsewhere specified	582,082	1,554,968
Rubber and friction tape	36,714	49,996
Globes and shades for lighting fixtures	59,722	65,385
Electrical glassware except for lighting	56,548	46,584
Electrical porcelain:		
For less than 6,600 volts	40,343	79,637
For 6,600 volts and over	59,349	101,134
Carbons, carbon brushes and electrodes:		
Electrodes for electric furnaces	245,038	200,038
Other carbon products	51,577	91,676
Insulated wire and cable, iron or steel	9,959	20,778
Copper, bare wire	220,052	256,533
Copper, insulated wire and cable	275,982	468,681
Refrigeration sets up to 1 ton capacity	593,220	.....
Refrigeration sets up to ¼ ton capacity	.....	1,184,456
Refrigeration sets over ¼ to 1 ton capacity	.....	181,036
Totals	$8,605,820	$12,221,805

DESTINATION OF ELECTRICAL EXPORTS

Country of Destination	April, 1929 Value
EUROPE:	$2,810,617
Belgium	106,201
France	345,528
Germany	247,589
Italy	221,466
Netherlands	87,318
Spain	227,493
Sweden	96,728
United Kingdom	1,082,304
Other countries	395,990
WESTERN HEMISPHERE:	$6,568,875
Canada	3,346,458
Mexico	331,144
Cuba	407,876
Argentina	782,266
Brazil	676,563
Chile	200,280
Colombia	178,841
Peru	84,154
Venezuela	107,377
Other countries	453,916
ASIA, AFRICA AND OCEANIA:	$2,842,313
British India	307,503
China	337,832
Japan	321,445
Philippine Islands	259,047
Australia	669,971
New Zealand	212,618
Union of South Africa	200,801
Other countries	533,096

Market Conditions

EXCEPT for some slackening in heavy apparatus business in the Eastern district orders and inquiries appear about normal. The summer lull continues to hold off and conditions are satisfactory. Industrial activity is somewhat spotty.

——SWITCH AND CONTROL EQUIPMENT ORDERS LEAD in New England.

——A LARGE ORDER FOR POWER TRANSFORMERS features week's business in St. Louis. Substation steel work and equipment ordered.

——SOUTHEAST REPORTS VOLUME GOOD for season of year, with generating equipment and accessories ordered. Prospects for the latter part of the year encouraging.

——RAILROAD EQUIPMENT UNUSUALLY HEAVY in Middle West, where, in spite of moderate seasonal recession in industrial business conditions, electrical and allied industries are satisfactory.

——WHILE BAY DISTRICT OF PACIFIC COAST ENJOYS especially satisfactory purchases for power companies, southern California is somewhat slack. Industrial activities are spotty.

EASTERN DISTRICT

The electrical equipment market in the Eastern district shows little change. Commitments are holding on a satisfactory basis, and while inquiries are showing an inclination to taper off in connection with heavy apparatus, forthcoming sales appear encouraging. A manufacturer of transformers for power and distribution service says that orders are declining and that inquiries are following in similar trend. A Philadelphia producer of prime movers reports a good demand, particularly from municipalities, with the outlook satisfactory for continuance. A city in Mississippi has contracted for a 660-hp. Diesel-electric unit, with accessories, while a municipality in Kentucky has purchased a similar unit of 550-hp. rating. A western Pennsylvania manufacturer has secured a contract for two 1,200-kw. generators from an irrigation organization on the Pacific Coast, to be direct connected to two Diesel engines, for which an order has been placed with a New York maker, the installation costing $109,000. A producer of Diesel engine units in Pennsylvania reports operations at maximum capacity and incoming orders are said to insure continuance of this schedule for some months to come. Compressor business, likewise, is excellent.

While immediate industrial account is inclined to be a little spotty, indications point to a good volume of business in motors, controls, switching apparatus and affiliated equipment for the next 60 days. A steel mill in Alabama has placed an order with a Pennsylvania manufacturer for complete electrical equipment for a reversing blooming mill, including control for operating mill tables, screwdown manipulators and auxiliaries. The installation will cost $300,000. A New York producer has received a commitment from a cotton mill in South Carolina for generating equipment for a mill, as well as village lighting service, to cost $80,000. A maker of control equipment, switching apparatus, etc., has received a contract from a metropolitan newspaper for motor drives for printing presses, totaling $35,000 and a producer of linotype machines has purchased a quantity of control apparatus for electric melting pots and kindred service. An iron and steel company in northern New York has purchased electric centrifugal compressor units from a state manufacturer to an amount of $60,000. Wire and cable business holds uniform. A leading maker of marine equipment reports an important commitment for a South African liner now in the course of building, including three Diesel-drive generator units for auxiliary power, as well as complete motors and controls both for deck and under-deck machinery. Construction projects are as follows:

The Gotham Silk Hosiery Company, New York, plans expansions in its mills to cost $1,000,000. The Department of Parks, New York, will soon ask for bids for a power plant and service station to cost $150,000. The Endicott-Johnson Shoe Corporation, Binghamton, N. Y., plans a factory at Owego, N. Y., to cost $400,000. The Garlock Packing Company, Palmyra, N. Y., will build an addition to cost $65,000. The Savoia Macaroni Company, Brooklyn, N. Y., will soon take bids on a factory addition to cost $100,000. The Ingersoll-Rand Company, New York, will build an addition to its mining machinery plant at Phillipsburg, N. J., to cost $100,000. The Jersey Central Power & Light Company, Asbury Park, N. J., will build a 50,000 kw. generating plant at South Amboy, N. J., to cost $5,000,000. The Essex County Vocational Schools, Newark, N. J., will receive bids until July 17 for special lighting fixtures for the Girl's Vocational School. The Gulf Refining Company, Pittsburgh, plans a 10,000 kw. steam-operated electric power plant at its refinery at Port Arthur, Tex., and an addition to the power house and other departments at the refining plant on Staten Island, N. Y., to cost $250,000. The Hess-Bright Manufacturing Company, Philadelphia, will build an addition to its ball bearing plant to cost $75,000. The Superior Paper Products Company, Carnegie, Pa., will take bids for an addition to cost $150,000. The Consolidated Gas, Electric Light & Power Company, Baltimore, Md., will build a transmission line from Friendship to Owings, Md. The General Purchasing Officer, Panama Canal, Washington, will receive bids until July 16 for insulated cable, circuit breakers, etc. (Panama Schedule 1972.)

NEW ENGLAND

Orders for switch and control equipment are of outstanding interest in the New England district. A northern New England power company placed orders amounting to $130,000 for a number of 220,000-volt disconnecting switches. Orders for station control switches are steady and in good volume. Two eastern Massachusetts stations recently purchased new equipment amounting to $4,000 and two substation contracts are pending, as well as switch and control equipment for a hydro-electric plant in Maine. In western Massachusetts a new hydro-electric plant will be built. Industrial equipment orders are confined mainly to small motors and control. One order of small motors amounting to $1,100 was reported. Fractional-horsepower motors are in demand for what is predicted to be a high level in the marketing of oil-burning equipment. New construction material is active and recent bookings of orders for elevator control and power equipment are encouraging. Orders for high-duty direct-connected booster pumping units are gaining. Line extensions are numerous, while service control transformers are selling well. Electric refrigeration leads in interest among merchandising equipment. Construction projects are as follows:

The New England Public Service Company, Augusta, Me., plans extensions in the transmission lines in vicinity of Bethlehem and Lisbon, N. H. The Boston & Albany Railroad Company, Boston, plans extensions in its shops at West Springfield, Mass., to cost $500,000.

SOUTHEAST

The volume of business in the Southeast holds up well for the season of the year and some individual orders of the moment are reported. General conditions are good and the prospects for fall business are bright. The largest order placed was for a 40,000-kva. waterwheel generator costing in excess of $150,000 to be installed in the Carolinas. Another order from this same company was for potheads, junction boxes and cable accessories costing $5,000. A Georgia company ordered for stock creosoted pine poles amounting to $12,700 and parkway cable totaling $12,200. Some satisfactory orders for copper are coming through, an Alabama company ordering two cars each of bare and weatherproof. A Georgia company ordered two cars of weatherproof wire, while a Carolina company ordered two cars of bare copper wire. One company's orders for small power and distribution transformers aggregated $7,700 and a central-station order was for $3,000 worth of street lighting equip-

ment. Central-station merchandising activities continue aggressive, one of the larger companies having concluded a two months electric refrigerator campaign in which sales were in excess of $1,000,000. A fiber plant in North Carolina ordered a turbine costing $75,000, a lumber plant in Florida ordered a turbine and condenser costing $60,000 and a textile plant in South Carolina ordered generating equipment amounting to $45,000. Construction projects are as follows:

The Tennessee-Eastman Corporation, Kingsport, Tenn., plans additions in its chemical plant to cost $1,000,000. The Sterling Wood Products Company, Knoxville, Tenn., will build an addition to cost $100,000. The Murray Corporation of America, Detroit, plans an additional plant unit at Memphis, Tenn., to cost $1,000,000. The Soddy Hosiery Mills, Inc., Soddy, Tenn., plans an addition to cost $80,000. The Interstate Utilities Company, Quitman, Miss., plans extensions in its power plant and ice-manufacturing plant at Waynesboro, Miss., to cost $50,000. The Southeastern Ice & Cold Storage Company, Lake Worth, Fla., plans extensions to cost $50,000. Jacksonville, Fla., plans a power substation at South Jacksonville, Fla., to cost $35,000.

Middle West

General business in the Middle West section at the close of the first half of the year has sustained expectations expressed earlier in the year. While some recession is noted in industrial business, conditions in the electrical and allied industries are entirely satisfactory. Railroad equipment purchasing has been unusually heavy. Steel mill operations are satisfactory and car loadings continue to exceed the million mark. The utility companies are busy with some new construction and a large amount of rehabilitation and revision work. Interesting orders placed include the construction of a 60-cycle switch house extension to cost $315,000, one oil circuit breaker, safety inclosed truck type, 600 amp., 15 kv., three-pole, single-throw, 115-volt solenoid-operated, three high-speed circuit breaker equipments rated at 5,000 amp. continuously, 7,500 amp. for two hours and five 6,400 amp., 7,500 amp. for 40 minutes, 650 volts maximum for use with 5,000-amp. rectifier units, six oil circuit breakers, outdoor type, 15 kv., 3,000 amp., 60 cycle, single pole, single throw, wheel mounted, two air circuit breakers, six pole, hand operated, 6,000 amp., 250 volt, three phase, 60 cycle a.c. with 24 volts direct-current, shunt trip coils, one storage battery for substation use and several construction orders aggregating $75,000. Jobbers' sales are normal for this period of the year. Construction projects are as follows:

The Glancy Malleable Iron Corporation, Waukesha, Wis., plans an addition to cost $110,000. The Automotive Fibre Company, Detroit, contemplates a plant to cost $100,000. The Ford Motor Company, Detroit, plans an addition to the aircraft plant at Dearborn, Mich., to cost $400,000. The Sparta Foundry Company, Sparta, Mich., plans additions to cost $100,000. The John Deere Plow Company, Moline, Ill., plans a factory branch and distributing plant at Aurora, Ill., to cost $65,000. The Ajax Quilting & Manufacturing Company, Chicago, plans an addition to cost $150,000. The Jensen Radio Company, Chicago, plans an addition to cost $100,000. The Home Laundry Company, Rockford, Ill., plans a plant to cost $95,000. The Monarch Aircraft Company, Rockford, Ill., plans an airplane plant to cost $85,000. Springfield, Ill., will receive bids until July 15 for extensions in its municipal power plant. The United States Corrugated Fibre Box Company, Indianapolis, Ind., plans an addition to cost $200,000. The Interstate Public Service Company, Indianapolis, Ind., plans a 66,000-volt transmission line to Martinsville, Bloomington, Ind., and vicinity, to cost $500,000. The Edwards Iron Works, South Bend, Ind., plans a storage and distributing plant to cost $60,000. The Sisters of the Good Shepherd, Cleveland, plan a power plant at the institution to cost $50,000. The Contracting Officer, Material Division, Air Corps, Wright Field, Dayton, Ohio, will receive bids until July 17 for a quantity of high-tension cable (Circular 27). The Ohio Seamless Tube Company, Shelby, Ohio, plans expansions to cost $75,000. The Pennsylvania-Ohio Power & Light Company, Youngstown, Ohio, will build a steel tower transmission line from Toronto to Akron, Ohio, to cost $450,000. The Flour City Ornamental Iron Company, Minneapolis, Minn., will build an addition to cost $85,000. Burlington, Iowa, will soon take bids for an ornamental lighting system. The Oldsmobile-Viking Company, Washington, Iowa, plans a plant to cost $100,000.

St. Louis District

The cool wet season in the St. Louis district has contributed to an unusually good radio business and caused the volume of fans handled to be 30 to 40 per cent below normal during the past week. A large local power company placed the largest order for transformers ever given in this district, amounting to nearly $900,000. This order included six station transformers stepping up to 132 kv., six substation units 60 cycles and six 25 cycles, stepping from 110-kv. to 13,200, and a bank of industrial substation units stepping down from 132 kv. to 13,200 volts. An order was received for steel work and switching equipment for a large substation from an Illinois power company to cost $26,000. The demand for stock sizes of apparatus and pole line hardware has held up to former reports. Construction projects are as follows:

The Air Terminal Corporation, Kansas City, Mo., plans a floodlighting system and beacon lamps at the local airport to cost $700,000. The Gardner Motor Company, St. Louis, contemplates expansions to cost $500,000. Clinton, Okla., plans a floodlighting system and beacon lamps at its municipal airport to cost $50,000. Miami, Okla., plans an ornamental lighting system to cost $30,000. Russellville, Ark., plans a municipal electric light and power plant to cost $150,000. The Corpus Christi Warehouse & Storage Company, Corpus Christi, Tex., plans a cold storage and refrigerating plant to cost $75,000. The Globe Oil & Refining Company, Blackwell, Okla., contemplates an oil refinery near Corpus Christi, Tex., to cost $150,000. The Texas & Pacific Railway Company, Fort Worth, Tex., plans a storage and distributing plant, with cold storage and refrigerating plant, to cost $2,000,000. Houston, Tex., plans a vocational school to cost $100,000. The Phillips Petroleum Company, Bartlesville, Okla., plans an oil refinery at Houston, Tex., to cost $500,000. The Tenaha Compress & Warehouse Company, Tenaha, Tex,. plans an addition to cost $75,000. Gonzales, La., contemplates a municipal electric light and power plant to cost $60,000. The Arkansas-Louisiana Pipe Line Company, Shreveport, La., plans a compressor plant at Sterlington, La., to cost $850,000.

Pacific Coast

June closes with good though spotty business on the Pacific Coast, power purchases being especially good in the Bay district and industrial business rather quiet, whereas the reverse is true for southern California. Power business includes four carloads aggregating 200,000 lb. of sizes No. 4/0 to No. 6 bare copper wire, eleven Westinghouse transformers, sizes 4,000 to 1,250 kva., valued at $85,000, trunk type switching equipment costing $55,000 for San Francisco, twelve induction regulators, valued at $20,000, General Electric switching gears valued at $25,000, oil circuit breaker parts valued at $3,000 and 38 General Electric 15,000-volt circuit breakers valued at $80,000. Industrial business includes $30,000 worth of Westinghouse storage battery locomotives for an Arizona mine, $20,000 worth of variable speed controllers for a Los Angeles steel mill, the construction of a new continuous bar steel mill at Pittsburg, Calif., and a dozen scattered packing and storage plants, each requiring about $10,000 worth of electrical material. Many other such plants have been postponed until next year because of frozen crops. July is expected to witness emergence of many large power projects from blueprint to bidding stage because this year's drought and rapidly increasing industrial load require them within two years. The recent Oakland street lighting bids averaging $55,000 were rejected and the Los Angeles rejection of a $20,000,000 bond issue held up much power machinery. Construction projects are as follows:

The Encinal Cannery, Alameda, Calif., plans a plant to cost $250,000. The Vita Fruit Products Company, Lodi, Calif., plans a plant to cost $100,000. The Pacific Gas & Electric Company, San Francisco, plans an equipment storage and distributing plant to cost $100,000. The Paramount Portland Cement Company, Los Angeles, plans a mill at Torrance, Calif., to cost $500,000. Baker, Ore., contemplates a municipal electric light and power plant to cost $85,000 Bremerton, Wash., has voted bonds for $750,000, for a municipal light and power system. Seattle, Wash., plans a municipal power substation. Butte, Mont., plans an ornamental lighting system. The Idaho Power Company, Boise, Idaho, plans a hydro-electric power plant on the Snake River, near Lewistown, Idaho, to cost $500,000. The Arizona Highline Reclamation Association, Phoenix, Ariz., plans a group of hydro-electric power plants on the Colorado River, to cost $20,000,000, with transmission lines.

Activities of the Trade

Amalgamated Electric Buys Langley Companies

The Amalgamated Electric Corporation, Limited, Toronto, Canada, has acquired the business of the Langley Electric Manufacturing Company, Limited, Winnipeg, and the Langley Manufacturing Company, Limited, Vancouver, manufacturers and distributors of electrical fittings and supplies.

The Amalgamated Electric Corporation, Limited, is a consolidation of the leading electrical fittings and supplies manufacturers in Canada, and previous to the present acquisition consisted of three manufacturing units, the Banfield division, Benjamin Electric division, both of Toronto, and the Duncan electrical division of Montreal. With the addition of the two Langley companies, the Amalgamated Electric Corporation will acquire between 80 per cent and 85 per cent of the business in electrical switches, industrial and residential illuminating equipment, fittings and devices, etc., in western Canada. Mr. Langley will continue to be associated with the business and will occupy an executive position in the consolidated companies, which will now comprise five independent manufacturing units in Canada.

THE EDWIN L. WIEGAND COMPANY, 422 First Avenue, Pittsburgh, manufacturer of electrical heating units, announces the appointment of J. V. Calhoun as its Eastern sales and engineering representative with headquarters at 800 Commercial Trust Building, Philadelphia.

THE DUDLO MANUFACTURING CORPORATION, Fort Wayne, Ind., manufacturer of electric coils, wire, etc., has appointed Niles E. Wallen as sales production manager in charge of the advertising and export trade of its company, succeeding William S. Mossman, who has resigned. Perry Cooper will take over the Indiana and Michigan sales territory, part of which had been covered by Mr. Wallen.

THE HOOVER COMPANY, North Canton, Ohio, manufacturer of electric vacuum cleaners, announces the following changes in its sales organization: F. M. Rhed will leave the post of branch manager at Kansas City, Mo., the territory comprising the states of Missouri, western Iowa, Nebraska, Kansas, Colorado and Wyoming, to take up the work of director of sales education and personnel. Lloyd Doolittle, Dallas, Tex., leaves the post of branch manager for Texas, Louisiana, Oklahoma and New Mexico to take over the vacancy at Kansas City, Mo. Harry T. Smith, district manager at Seattle, Wash., is promoted to branch manager at Dallas, Tex. H. R. Kelly leaves Spokane, Wash., to succeed Mr. Smith, and R. A. Page, supervisor at Spokane, is advanced to the district managership at Spokane.

THE GRISCOM-RUSSELL COMPANY, 285 Madison Avenue, New York City, manufacturer of power plant steam specialties, has established a sales office at the Lewis Building, Portland, Ore.

THE TRUSCON STEEL COMPANY, Youngstown, Ohio, announces that Larry A. Barnett, manager of the transmission structures division of the company, has transferred his office from Youngstown, Ohio, to 90 West Street, New York City.

THE FORD CHAIN BLOCK COMPANY, Second and Diamond Streets, Philadelphia, manufacturer of overhead trolleys and hoists, announces the appointment of C. A. Anderson as its sales manager.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY has received an order from the Gulf States Steel Company, for electrical equipment to drive a 40-in. reversing blooming mill to be installed at its Alabama City, Ala., plant.

THE ALLEN-BRADLEY COMPANY, Milwaukee, manufacturer of electric control apparatus, announces the appointment of F. L. Reynolds as its district representative in the western Michigan territory with headquarters at 4143 Ellsworth Avenue, Grand Rapids, Mich.

THE MAJESTIC ELECTRIC APPLIANCE COMPANY, INC., San Francisco, has appointed Arthur Kempston, formerly manager of the Apex Manufacturing Company, Oakland, Calif., as its Eastern manager with headquarters in Philadelphia. Mr. Kempston will have charge of all the territory east of the Mississippi River in the distribution of the Majestic company's products.

THE HURLEY MACHINE COMPANY, 22d Street and 54th Avenue, Chicago, manufacturer of "Thor" washing machines, ironers, etc., is adding a large manufacturing unit to its plant at Cicero, Ill. The new building will give it an additional 50,000 sq.ft. of manufacturing and shipping facilities. The company also is building a new modern foundry on its Cicero property and will move its present foundry from Waukegan, Ill., when the building is completed.

THE MODERN ENGINEERING COMPANY, 3411 Pine Boulevard, St. Louis, manufacturer of "Meco" welding and cutting apparatus, has appointed the Modern Engineering Company, Louisville, Ky., as exclusive distributors for Louisville and surrounding territory for its company. This organization specializes in welding supplies and is headed by Max Abrams. The Sales Engineering Company, Milwaukee, has been appointed exclusive Wisconsin distributor for the company. This company also specializes in welding supplies and is headed by A. H. Friese.

British Electrical Merger Issues First Figures

The first balance sheet of the Associated Electrical Industries, the title assumed by the Metropolitan-Vickers Electrical Company in its enlarged form, shows a great expansion in the figures. The total of the balance sheet is £8,548,294 ($42,741,470), of which £2,132,115 ($10,660,575) is represented by the shareholdings in its new subsidiaries. These consist of 1,920,140 ordinary shares of £1 in the British Thomson-Houston Company, 887,214 ordinary shares of 4s., and 8,009 preference shares of £1 in the Edison Swan Electric Company, and 149,367 £1 shares in Ferguson Pailin, Ltd.

As a result of the new issue of ordinary shares at the end of last year the issued share capital has been increased from £2,395,000 ($11,975,000) to £3,952,902 ($19,764,510). Debenture indebtedness is unaltered, but the new balance sheet shows a temporary loan of £700,000. The profit and loss figures apply only to the activities of the company in its old form, no dividends of the associated companies having been taken into account. The net profits were virtually the same as for 1927 and the dividend is again 6 per cent. The output was again a record, and as the "input" of new orders was greater than in 1927 the orders in hand were maintained at a satisfactory level.

THE NATIONAL LAMP WORKS of the General Electric Company, Nela Park, Cleveland, has appointed R. P. Burrows as manager of its Pacific division, succeeding A. M. Sweeney, who will be located in the sales department at Nela Park. Mr. Burrows will have charge of the National Lamp Works Sales in eight far Western states. His headquarters will be at Oakland, Calif.

COPELAND PRODUCTS, INC., Detroit, manufacturer of electric refrigerators, has purchased the entire control of the Chicago distributor, which has been operating under the name of the Copeland Refrigeration Company of Chicago. C. L. Welch has been appointed general manager of the Chicago branch and will take charge of the office, which will continue to be operated under the name of the Copeland Refrigeration Company of Chicago.

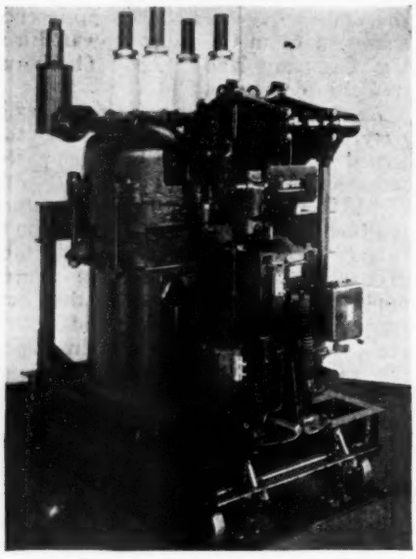
THE WESTINGHOUSE ELECTRIC ELEVATOR COMPANY, a subsidiary of the Westinghouse Electric & Manufacturing Company, announces the purchase of the Norton-Blair-Douglass Company, New York City, manufacturer of elevator signals and electric and manual door operators. It has formerly been the practice with elevator companies to purchase these devices outside, but this acquisition gives the Westinghouse company a better control of all engineering features of elevator installations.

New Equipment Available

Truck Type Oil Circuit Breaker

A new type F-120-15 D, 4,000-amp. truck type oil circuit breaker for 15,000-volt service is announced by the Condit Electric Manufacturing Corporation, Boston. This is a heavy duty addition to its F-120 line of power breakers.

To afford the necessary current capacity without undue heating four studs per each pole unit are used, each with



a capacity of 2,000 amp. Inside the breaker these studs are clamped in a pair of heavy contact blocks, two studs to each block. From each block extend three inverted laminated brushes, all of which make firm contact with a single bridging member of heavy copper.

The arcing contacts are designed on the principle of energy absorption. Eight heavy cylindrical blocks of copper afford such thermal absorption capacity as materially to reduce arcing on interrupting. Four series breaks are used, further reducing the duration of arcing. The design of the arcing contact circuit makes use of the electromagnetic forces developed on high-current rushes to insure the arcing contacts remain closed with strong pressure until the brushes have safely parted.

This type circuit breaker has an estimated interrupting capacity of 1,000,000 kva. at 15,000 volts.

Pigtail and Terminal Type Receptacles with Covers

A new method of attaching pigtail and terminal type porcelain receptacles to box covers is announced by the National Metal Molding Division of the National Electric Products Corporation, Pittsburgh.

The improvement embodies securing the porcelain receptacle to the cover by means of metal tension clips that are screwed to the cover and fit over a flange at the back of the porcelain, keeping it tightly in the cover hole. Due to flexibility of the metal clips, direct jars and blows will not break the porcelain.

This new type of fastening eliminates the breakage in handling and shipping, it is claimed, and the loss of time and labor in securing replacements. Projection of the porcelain inside the box is reduced to a minimum, which increases the working room inside the box. The shade holder ring on the porcelain is large and sharply defined.

Extended Ear Switch Boxes

Labor-saving extended ear switch boxes for cable and loom are now being manufactured by the National Metal Molding Division of the National Electric Products Corporation, Pittsburgh, Pa. These boxes have ears 6 in. long, assembled on the ends for vertical mounting in ordinary lath and plaster walls, and on the sides for horizontal mounting in ordinary lath and plaster walls and behind baseboards. These fasten solidly to studding and timbers so that plaster will not crack around them.

By setting the triangular points against the studding and striking the ears with a hammer the points are sunk into the timber and the switch box is held in the desired position temporarily. The job is finished by driving nails through the holes in the ears into the studding.

The ears are fastened to the boxes by screws. They are galvanized steel and angular in shape for strength. Each has six triangular projecting points spaced to set the switch box out from the studding for the door trim and other finishes of the standard 3- to 5-in. widths.

Welding Generators of the Belted and Coupled Type

To complete its line of welding equipment the Westinghouse Electric & Manufacturing Company has recently brought out new 300- and 400-amp., single-operator, arc-welding generators of the belted and coupled type, which may be used where driving power, such as motors, gasoline engines, tractors, line shafting, etc., is already available. Speeds of 1,750 and 1,450 r.p.m., clockwise and counter-clockwise rotation, provide ratings for every application.

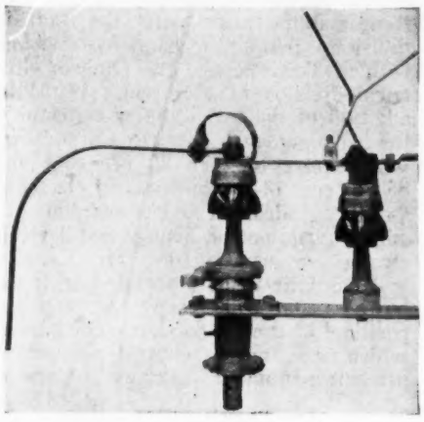
The complete unit includes a generator, direct-connected exciter, control panel and reactor. The generators have small over-all dimensions to permit mounting where space is at a premium. The control for the unit is mounted on top of the generator frame and is inclosed by a sheet metal cabinet. It includes a voltmeter, ammeter and single dial field rheostat for adjusting the welding current over the entire range. The welding current range of the 300-amp. unit is 90 to 375 amp., while that of the 400-amp. unit is 120 to 500 amp.

The welding generators are all special type SK, single-operator, constant-current, differentially compound wound, separately excited generators.

Switch for Rural Lines

To meet the demand for low-cost, pole-top, gang-operated switches for use on lines up to and including 4.5 kv., the Delta Star Electric Company, Chicago, has developed in 100 amp. capacity type PMB, form 1.

By means of an interlocked operating



mechanism, these elements can be combined into two- or three-pole switches for mounting on double crossarms. This new gang-operated switch will eliminate the use of switch sticks, necessary with single-pole disconnectors.

Solderless Connector with Locking Action

A new connector which is stated to make permanently tight mechanical and electrical connections without solder is announced by the Penn-Union Electric Corporation, Erie, Pa., for use on high-tension lines.

When the lock-nut is turned onto the yoke a split wedge-shaped sleeve forces the body of the connector up tight against the main conductor. At the same time the sleeve clamps tighter to the branch, equalizing the pressure on the main and branch conductors. It tightens to the main and branch conductors simultaneously by one operation, with the clamping pressure always equalizing itself between the two conductors.

It is stated that engineers using this connector assert that it has an unusually large current-carrying capacity due to generous contact areas and permanent tightness. Sudden surges of current and high overcharges are carried easily. Tests are said to indicate that the connector has an actual capacity far above requirements.

Electrical Patents

Announced by U. S. Patent Office

(Issued June 18, 1929)

1,718,139. BATTERY PLATE AND PROCESS OF MAKING SAME; W. H. Grimditch, Philadelphia, Pa. App. filed Dec. 1, 1921.

1,718,147. DRIVING DEVICE; E. Hermann and F. Pohn, Vienna, Austria. App. filed Oct. 7, 1927.

1,718,172. ELECTRIC FURNACE; W. E. Moore, Pittsburgh, Pa. App. filed Sept. 7, 1916.

1,718,185. ELECTRICAL CONDENSER; H. R. Van Deventer, New York, N. Y. App. filed March 11, 1925.

1,718,194. INSULATED ELECTRIC CONDUCTOR; R. J. Nicholson, Wheaton, Ill. App. filed March 7, 1927.

(Issued June 25, 1929)

17,341 (reissue). FUSE PLUG; L. Baenziger, Abington, Mass. App. filed Feb. 21, 1929.

1,718,232. SYSTEM OF MOTOR CONTROL; H. Haehle, Milwaukee, and S. Kraynick, West Allis, Wis. App. filed Sept. 20, 1924.

1,718,238. SYSTEM OF GAS CONTROL; C. F. Kettering and W. A. Chryst, Dayton, Ohio. App. filed July 17, 1924.

1,718,241. AUTOMATIC CONTROLLER FOR BOILER WATER SUPPLY; H. F. Laas, St. Paul, Minn. App. filed Nov. 29, 1926.

1,718,251. TRANSMISSION-SYSTEM SWITCH; T. Panzerbieter, Berlin-Charlottenburg, and W. Nagel, Berlin, Germany. App. filed May 8, 1925.

1,718,259. INSULATOR; A. C. Scott, Dallas, and W. G. Rupe, Cameron, Tex. App. filed Feb. 1, 1926.

1,718,260. ELECTRICAL COOKING APPLIANCE; B. Shaffer, Minneapolis, Minn. App. filed Jan. 11, 1928.

1,718,269. ELECTRIC CONTROLLER; C. W. Wyman, Claremont, N. H. App. filed June 14, 1918.

1,718,278. CONDENSER; W. Dubilier, New York, N. Y. App. filed Feb. 14, 1924.

1,718,303. ELECTRIC WATER HEATER; W. H. Orr, Camden, N. J. App. filed Aug. 12, 1927.

1,718,336. GOVERNOR; D. C. Davis, Montclair, N. J. App. filed Feb. 26, 1926.

1,718,352. METHOD OF LOCATING UNDERGROUND CONDUCTIVE BODIES; E. H. Guilford, Darwin, Calif. App. filed Aug. 11, 1926.

1,718,364. ELECTRICAL HEATING AND FORGING MACHINE; F. P. Kobert, Springfield, Mass. App. filed May 13, 1927.

1,718,412. ELECTRIC HEATER; E. R. Crooker and H. C. Newman, Los Angeles, Calif. App. filed Feb. 6, 1925.

1,718,422. DISTANCE MEASURING WITH THE AID OF SOUND WAVES; W. Kunze, Bremen, Germany. App. filed Dec. 7, 1922.

1,718,424. ENGINE STARTER; W. L. McGrath, Elmira, N. Y. App. filed Nov. 16, 1925.

1,718,448. AUTOMATIC RECLOSING CIRCUIT-BREAKER SYSTEM; K. Yamazaki, Tokio-Fu, Japan. App. filed March 10, 1928.

1,718,451. SHOCK-ABSORBING SOCKET; R. B. Benjamin, Chicago, Ill. App. filed Oct. 9, 1925.

1,718,454. ELECTRICAL SYSTEM; R. N. Conwell, Bloomfield, N. J. App. filed July 28, 1923.

1,718,471. MAIL BOX; F. W. Mathis, Evergreen, Va. App. filed April 30, 1926.

1,718,477. SYNCHRONIZING SYSTEM; F. W. Meyer, Braunschweig, Germany. App. filed Jan. 23, 1925.

1,718,478. ELECTRIC SWITCH; H. F. Morse, Southport, Conn. App. filed May 24, 1927.

1,718,489. ELECTRIC SWITCH; R. Renke, Buffalo, N. Y. App. filed Jan. 22, 1926.

1,718,494. ELECTROMAGNETIC PRESSURE-MEASURING MEANS; O. R. Schurig, Schenectady, N. Y. App. filed Aug. 2, 1923.

1,718,497. TELEMETRIC SYSTEM; B. W. St. Clair, Lynn, Mass. App. filed June 20, 1924.

1,718,500. ELECTRIC RELAY; O. C. Traver, Schenectady, N. Y. App. filed June 15, 1925.

1,718,501. ELECTRIC SWITCH; H. Trencham, Ruislip, H. C. Heath, Wembley, and C. W. Newton, Harlesden, London, England. App. filed Sept. 8, 1925.

1,718,504. ELECTRICAL CONNECTER DEVICE; C. E. Warner, Berwyn, Ill. App. filed March 23, 1922.

1,718,515. RECTIFYING APPARATUS; E. F. W. Alexanderson, Schenectady, N. Y. App. filed March 17, 1926.

1,718,516. AUTOMATIC RECLOSING CIRCUIT-BREAKER SYSTEM; A. E. Anderson, Lansdowne, Pa. App. filed Feb. 11, 1928.

1,718,517. SYSTEM OF ELECTRIC DISTRIBUTION; H. Bany, Yeadon, Pa. App. filed Jan. 19, 1928.

1,718,518. CAP PLUG; L. Barnett, Brooklyn, N. Y. App. filed Feb. 8, 1927.

1,718,523. AUTOMATIC TIME-ELEMENT RELAY AND CONTROL SYSTEM EMPLOYING THE SAME; J. E. Brobst, Schenectady, N. Y. App. filed Dec. 27, 1924.

1,718,529. TESTING APPARATUS; F. T. Coldwell, Alplaus, N. Y. App. filed May 1, 1928.

1,718,531. PROTECTIVE ARRANGEMENT; R. E. Cordray, Schenectady, N. Y. App. filed June 27, 1928.

1,718,537. CORD SET; F. C. De Reamer, Bridgeport, Conn. App. filed May 27, 1927.

1,718,643. HORN-BUTTON CONTACT; A. G. Geistert, Detroit, Mich. App. filed March 29, 1926.

1,718,663. METALLIC RECTIFIER CONSTRUCTION; C. E. Ogden, Cincinnati, Ohio. App. filed Feb. 17, 1928.

1,718,676. ELECTRIC HEATING UNIT; C. C. Abbott and G. D. Milnes, Pittsfield, Mass. App. filed Jan. 7, 1926.

1,718,681. MOUNTING FOR OIL BURNERS; W. McK. Braybrooks, Philadelphia, Pa. App. filed Dec. 5, 1927.

1,718,687. METHOD OF DETERMINING THE CONTENT OF FOREIGN SUBSTANCES IN IRON AND STEEL; B. D. Enlund, Degerfors, Sweden. App. filed Aug. 16, 1927.

1,718,715. ELECTRIC RIVETING MACHINE; J. A. Spencer, Revere, Mass. App. filed May 10, 1924.

1,718,716. CIRCUIT-INTERRUPTING DEVICE; J. A. Sencer, Revere, Mass. App. filed Feb. 26, 1925.

1,718,717. DOUBLE-THROW SWITCH; J. C. Stearns, Worcester, Mass. App. filed Dec. 10, 1926.

1,718,809. ELECTRIC SWITCH; G. A. Burnham, Saugus, Mass. App. filed July 3, 1922.

1,718,817. CABLE CONNECTER; A. E. Greene, Medford Hillside, Mass. App. filed April 1, 1925.

1,718,857. AUTOMATIC FIRE ALARM; O. B. Elliott, Dunedin, New Zealand. App. filed Oct. 23, 1920.

1,718,865 and 1,718,866. LIQUID HEATER; B. W. Macy, Jacksonville, Fla. Apps. filed June 4 and June 11, 1928.

1,718,878. OUTLET BOX; J. G. Raquette, Aurora, Ill. App. filed July 22, 1925.

1,718,920. ELECTRICAL CABLE; O. A. Frederickson, Wethersfield, Conn. App. filed Sept. 7, 1926.

1,718,927. SEARCHLIGHT; C. A. B. Halvorson, Jr., Lynn, Mass. App. filed June 26, 1920.

1,718,928. ARC-LAMP EQUIPMENT; C. A. B. Halvorson, Jr., Lynn, Mass. App. filed May 10, 1923.

Information on foreign patents can be obtained through the nearest district office of the Bureau of Foreign and Domestic Commerce, Department of Commerce.

New Trade Literature

LATHES.—The South Bend Lathe Works, South Bend, Ind., has issued catalog No. 90-A which contains illustrations, descriptions and prices of the entire South Bend lines of lathes from the 9-in. size to the 18-in. size. Several new lathe attachments which are offered for the first time also are included.

FLOODLIGHTS. — Bulletin No. 2134 issued by the Crouse-Hinds Company, Syracuse, N. Y., covers its type ADA floodlights for universal service.

RELAYS, MOTOR-GENERATOR SETS, REGULATORS, ETC.—The General Electric Company, Schenectady, N. Y., has issued a series of bulletins. Bulletin GEA-86A describes and illustrates its single-phase directional over-current relays; GEA-394A covers its induction motor-generator sets rated at ½ to 35 kw., 125 or 250 volts; GEA-709A describes its automatic generator-voltage regulators; GEA-722A describes the "Selsyn" devices for remote signaling, control and indication; GEA-874D and GEA-875D cover its belt, motor or gas-engine driven, self-excited, variable-voltage, single-operator, stationary or portable type WD-200A and type WD-300A arc welders; GEA-900A describes its type PK-1 test blocks and plugs for instruments, meters and relays; GEA-904B describes its single-stage centrifugal air compressors for cupola blowing; GEA-970A covers its type PQ relays; GEA-1104 covers the G-E motor drive for metal-working machinery; GEA-1105 describes its types, HE-1, PF-2, PG-1 and MG-2 undervoltage devices for manually and electrically operated oil circuit breakers; GEA-1116 covers it current-limiting reactors; GEA-1125 contains information on the G-E arc-welding school conducted at Schenectady and GEA-1142 describes its type EW resistors for mine and industrial haulage locomotives.

RECTIFIERS. — A number of bulletins published by the Kodel Electric & Manufacturing Company, Cincinnati, Ohio, describe and illustrate and contain technical data and information of general interest on the "Kuprox" improved copper oxide rectifiers for nearly every commercial, radio or scientific requirement.

WINCHES, CRANES AND DERRICKS. —Catalog No. 31 issued by the Mead-Morrison Manufacturing Company, East Boston, Mass., covers its winches, cranes and pole derricks. Many illustrations are given showing typical installations.

BAROMETER AND VACUUM RECORDER. — The Uehling Instrument Company, Paterson, N. J., is distributing bulletin No. 150 describing the Uehling combined barometer and vacuum recorder for steam turbines. The bulletin contains a picture of the operation of the instrument and gives the whole story of condenser performance on one chart.

COMBUSTION.—The first issue of a new magazine, *Combustion*, published by the In-Ce-Co Publishing Corporation, a subsidiary of the International Combustion Engineering Corporation, 200 Madison Avenue, New York City, is now being distributed. The right to the name "Combustion" has been purchased from the former user and the latter paper will now appear under a different name. Design, material, trends, theory and economics of furnace practices are covered by well-known engineers in the July issue.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number;

Purchase and agency are desired in Alexandria, Egypt (No. 39,202), for storage batteries and parts and insulated wire for automobiles.

An agency is desired in Sydney, Australia (No. 39,198), for electric cloth cutters and household electrical appliances.

Purchase and agency are desired in Montreal, Canada (No. 39,277), for fruit-juice extractors, sandwich toasters and grills.

An agency is desired in Sheffield, England (No. 39,217), for household appliances (vacuum cleaners and washing machines) and lighting fixtures.

An agency is desired in Tallinn, Estonia (No. 39,214), for household electrical appliances and wiring supplies.

An agency is desired in Fusan, Korea (No. 39,213), for household electric refrigerators.

An agency is desired in Montreal, Canada, (No. 39,216), for electrical baggage trucks and another (No. 39,250), for wiring supplies and lighting fixtures.

An agency is desired in Oslo, Norway (No. 39,218), for violet-ray apparatus and accessories.

An agency is desired in Vienna, Austria, (No. 39,215), for wiring supplies.

Directory of Electrical Associations

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, M. E. McIver, 8 South Michigan Av., Chicago, Ill.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. General secretary, J. W. Welsh, 292 Madison Ave., New York City.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Colin G. Fink, Columbia University, New York City.

AMERICAN ENGINEERING COUNCIL. Executive secretary, L. W. Wallace, 26 Jackson Place, Washington, D. C.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS, INC. Secretary, P. W. Henry, 75 West St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. National secretary, F. L. Hutchinson, 33 West 39th St., New York City. Board of directors meets bi-monthly. Sections and branches meet monthly in the principal electrical centers throughout the country. Three national and several regional conventions held each year.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Secretary, C. W. Rice, 29 West 39th St., New York.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary-treasurer, C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

AMERICAN STANDARDS ASSOCIATION. Secretary P. G. Agnew, 29 West 39th St., New York City.

AMERICAN WELDING SOCIETY. Secretary, M. M. Kelly, 29 West 39th St., New York.

ARIZONA UTILITIES ASSOCIATION. Executive secretary, Lee C. McCullough, 134 South Central Avenue, Phoenix, Ariz.

ARKANSAS UTILITIES ASSOCIATION. Secretary-treasurer, R. I. Brown, Arkansas Power & Light Co., Little Rock, Ark.

ARTISTIC LIGHTING EQUIPMENT ASSOCIATION. Managing director, C. L. Benjamin, 711 Graybar Bldg., 420 Lexington Ave., New York City.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, Preston S. Millar, 80th St. and East End Ave., New York.

ASSOCIATION OF ELECTRAGISTS INTERNATIONAL (formerly National Association of Electrical Contractors and Dealers). Secretary, Laurence W. Davis, 420 Lexington Ave., New York City, N. Y. Direct membership throughout the United States and Canada.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Managing director, John F. Kelly, Empire Bldg., Pittsburgh, Pa.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Joseph A. Andreucetti, Room 411, C. & N. W. Terminal Station, Chicago, Ill.

CANADIAN ELECTRICAL ASSOCIATION (affiliated with N.E.L.A.). Secretary, H. M. Lyster, 405 Power Bldg., Montreal.

COLORADO UTILITIES ASSOCIATION. Secretary-treasurer, O. A. Weller, Public Service Co. of Colorado, Denver, Colo.

EAST CENTRAL GEOGRAPHIC DIVISION, N.E.L.A. Secretary, D. L. Gaskill, Greenville, Ohio.

EASTERN GEOGRAPHIC DIVISION, N.E.L.A. Secretary-treasurer, Harold A. Buch, Telegraph Building, Harrisburg, Pa. Managing director, A. B. Millar.

ELECTRIC ASSOCIATION (THE) (Chicago). Manager, R. Bourke Corcoran, 30 North Dearborn St., Chicago, Ill.

ELECTRICAL LEAGUE OF COLORADO. Executive manager, George Bakewell, Jr., Gas & Electric Bldg., Denver, Colo.

ELECTRICAL LEAGUE OF UTAH. Executive secretary, R. E. Folland, Newhouse Hotel, Salt Lake City, Utah.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, Grand Central Terminal, New York City.

FLORIDA ENGINEERING SOCIETY. Secretary, J. R. Benton, Gainesville, Fla.

GEORGIA ELECTRICAL ASSOCIATION. Secretary-treasurer, J. J. McDonough, Georgia Power Co., Dublin, Ga.

GREAT LAKES GEOGRAPHIC DIVISION, N.E.L.A. Secretary-treasurer. T. C. Polk, Room 910, 140 South Dearborn St., Chicago.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary-treasurer, George W. Schwaner, 205 Illinois Mine Workers' Bldg., Springfield, Ill.

ILLUMINATING ENGINEERING SOCIETY. General secretary, A. B. Oday, 29 West 39th St., New York City.

ILLUMINATING GLASSWARE GUILD. Assistant business manager, C. H. Ferris, Stevenson Corp., 19 West 44th St., New York City.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, William Stokes, 1548 Consolidated Building, Indianapolis, Ind.

INSTITUTE OF RADIO ENGINEERS. Secretary, John M. Clayton, 33 West 39th St., New York City.

INTERNATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Victor H. Tousley, 612 North Michigan Ave., Chicago. Eastern, Western, Southwestern, Northwestern and Southern Sections.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, H. N. Lang, P. O. Box 1864, Orlando, Fla.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body formed of 26 national electrotechnical committees). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

IOWA SECTION, N.E.L.A. Secretary and treasurer, H. E. Weeks, Davenport, Iowa.

KANSAS SECTION, N.E.L.A. Secretary, H. Lee Jones, Kansas Gas & Electric Co., Wichita, Kan.

KENTUCKY ASSOCIATION OF PUBLIC UTILITIES. Secretary, E. F. Kelley, Louisville Railway Company, Louisville, Ky.

MARYLAND UTILITIES ASSOCIATION. Secretary, D. E. Kinnear, United Railways & Electric Co. of Baltimore, 803 Court Square Bldg., Baltimore, Md.

MICHIGAN ELECTRIC LIGHT ASSOCIATION. Secretary, Herbert Silvester, 401 South Street, Ann Arbor, Mich.

MIDDLE WEST GEOGRAPHIC DIVISION, N.E.L.A. Secretary-treasurer, Thorne Browne, 1527 Sharp Bldg., Lincoln, Neb.

MISSOURI ASSOCIATION OF PUBLIC UTILITIES. Secretary, F. D. Beardslee, 315 North 12th St., St. Louis, Mo.

NATIONAL ASSOCIATION OF RAILROAD AND UTILITIES COMMISSIONERS. Secretary, James B. Walker, 270 Madison Ave., New York.

NATIONAL COMMITTEE ON THE RELATION OF ELECTRICITY TO AGRICULTURE. Director, E. A. White, 1120 Garland Bldg., Chicago.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Managing director, Paul S. Clapp, 420 Lexington Avenue, New York City.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1008 Marquette Building, Chicago, Ill. Central, New England, New York, Middle and Southern Atlantic States and Pacific Coast Divisions.

NATIONAL ELECTRICAL MANUFACTURERS' ASSOCIATION (consolidation of Associated Manufacturers of Electrical Supplies, Electric Power Club and Electrical Manufacturers' Council). Managing director, Alfred E. Waller, 420 Lexington Ave., New York City.

NATIONAL ELECTRICAL WHOLESALERS' ASSOCIATION. Managing director, E. Donald Tolles, 165 Broadway, New York City. Pacific Coast Division: Secretary, Albert H. Elliot, 502 Flatiron Bldg., San Francisco.

NATIONAL FIRE PROTECTION ASSOCIATION. Chairman of electrical committee, A. R. Small, 109 Leonard St., New York City.

NATIONAL SAFETY COUNCIL. Managing director and secretary, W. H. Cameron, 108 East Ohio St., Chicago, Ill.

NEBRASKA SECTION, N.E.L.A. Secretary-treasurer, Thorne Browne, 1527 Sharp Building, Lincoln, Neb.

NEW ENGLAND GEOGRAPHIC DIVISION, N.E.L.A. Secretary, Miss O. A. Bursiel, Statler Building, 30 Providence St., Boston, Mass.

NEW JERSEY ELECTRIC ASSOCIATION. Secretary-treasurer, S. F. Delany, 1600 Pacific Ave., Atlantic City, N. J.

NEW MEXICO UTILITIES ASSOCIATION. Secretary-treasurer, Bernard L. Wiles, Albuquerque, N. M.

NEW YORK ELECTRICAL LEAGUE. Secretary, David T. Brown, 270 Canal St, New York City.

NEW YORK ELECTRICAL SOCIETY. Secretary, Frederic M. Delano, 29 West 39th St., New York City.

NORTH CENTRAL ELECTRIC ASSOCIATION (Geographic Division N.E.L.A.). Secretary-manager, J. W. Lapham, 803 Plymouth Bldg., Minneapolis, Minn.

NORTHWEST ELECTRIC LIGHT AND POWER ASSOCIATION (Geographic Division N.E.L.A.). Secretary, Berkeley Snow, 1206 Spalding Building, Portland, Ore.

OKLAHOMA UTILITIES ASSOCIATION. Manager, E. F. McKay, 1020 Petroleum Building, Oklahoma City, Okla.

PACIFIC COAST ELECTRICAL ASSOCIATION (Geographic Division N.E.L.A.). Secretary, Samuel H. Taylor, Suite 729-730, 447 Sutter St., San Francisco, Cal.

PENNSYLVANIA ELECTRIC ASSOCIATION (State Section N.E.L.A.). Managing director, A. B. Millar; secretary-treasurer, Harold A. Buch, Telegraph Bldg., Harrisburg, Pa.

PUBLIC UTILITIES ASSOCIATION OF VIRGINIA. Secretary, A. B. Tunis, 306 Grace Securities Bldg., Richmond, Va.

PUBLIC UTILITIES ASSOCIATION OF WEST VIRGINIA. Secretary, A. Bliss McCrum, P.O. box 1483, Charleston, W. Va.

ROCKY MOUNTAIN GEOGRAPHIC DIVISION, N.E.L.A. Secretary, O. A. Weller, Public Service Co. of Colorado, Denver, Col.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. President, W. W. Freeman; chairman executive committee, C. L. Edgar; secretary-treasurer, J. Smieton, Jr., 420 Lexington Ave., New York. Annual meeting second Friday in September; directors' meetings second Friday in March, June, September and December; executive committee meetings every thirty days.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Prof. F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

SOCIETY OF INDUSTRIAL ENGINEERS. Secretary, Geo. C. Dent, 205 W. Wacker Drive, Chicago, Ill.

SOUTHEASTERN GEOGRAPHIC DIVISION, N.E.L.A. Executive secretary, C. M. Kilian, 207 Bona Allen Bldg., Atlanta, Ga.

SOUTHEASTERN WATER AND LIGHT ASSOCIATION. Secretary-treasurer, F. W. Chapman, Camden, S. C.

SOUTHWESTERN GEOGRAPHIC DIVISION, N.E.L.A. Secretary, S. J. Ballinger, San Antonio Public Service Company, San Antonio, Tex.

SOUTHWESTERN PUBLIC SERVICE ASSOCIATION. Secretary, E. N. Willis, 403-4 Slaughter Bldg., Dallas, Tex.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, L. E. Merrow, Montpelier, Vt.

WESTERN SOCIETY OF ENGINEERS. Secretary, E. S. Nethercut, 205 West Wacker Drive, Chicago, Ill.

WISCONSIN STATE ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Chairman, George Andrae, 2040 Clybourn Ave., Milwaukee, Wis.

WISCONSIN UTILITIES ASSOCIATION. Executive secretary, John N. Cadby, 105 Wells St., Milwaukee, Wis.

WYOMING UTILITIES ASSOCIATION. Secretary, Frank Prost, Mountain States Telephone & Telegraph Co., Casper, Wyo.

Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

Half the Industrial Power Is Purchased

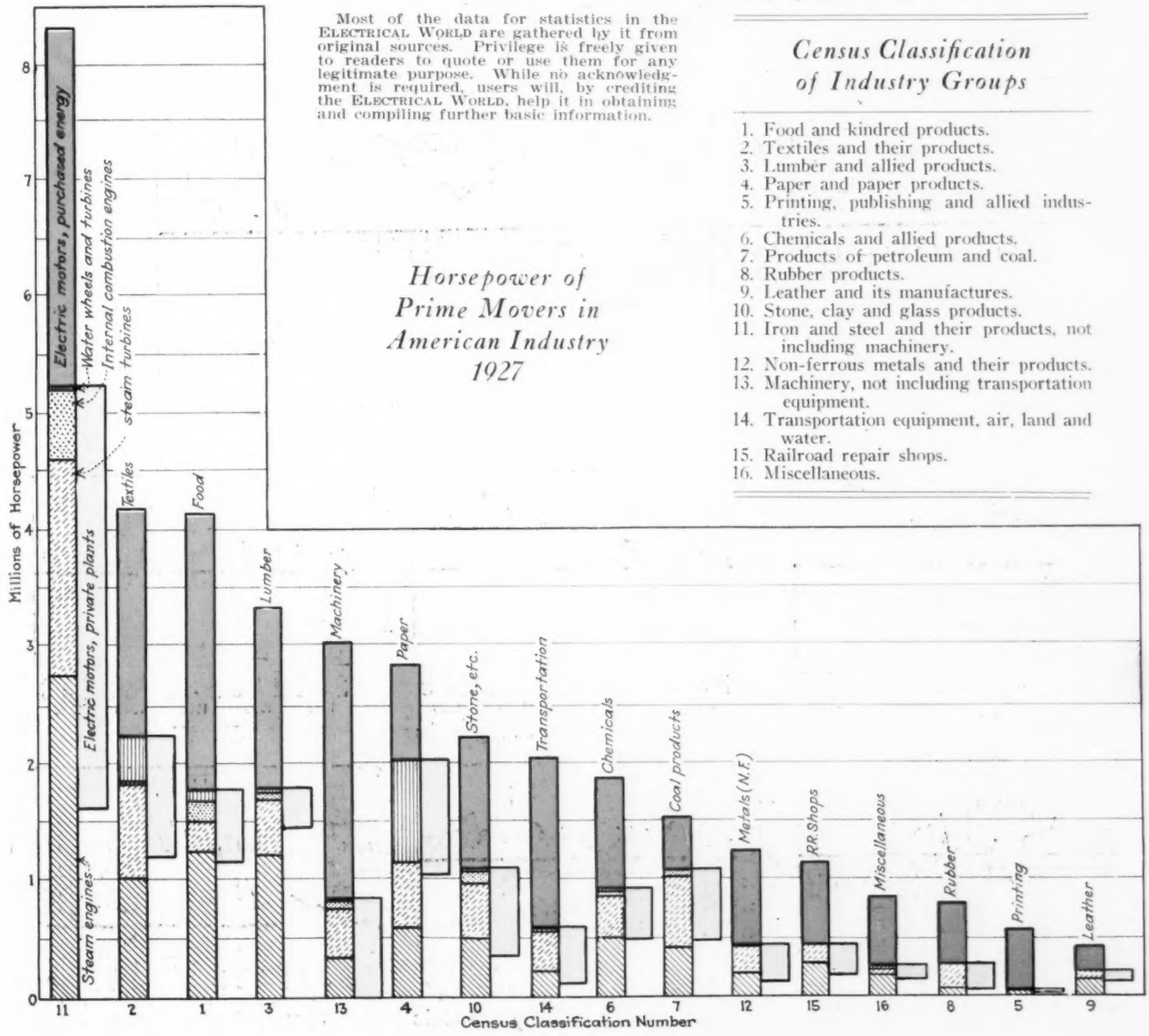
THE increasing application of industrial motor drive concerns every branch of the electrical industry. A net addition of four and a quarter million horsepower in two years does not mean merely converting so much copper and iron and other raw materials into electric machinery. It has called for planning by engineers. It has required the labor of wiremen and other construction men, the use of vast quantities of wire, cable, ducts and supplies for connecting up over four hundred thousand individual machines, the expansion of generating facilities, lines and substations. To the various industries it has meant the advantages and economies of the electric method.

Almost exactly half the installed horsepower, according to the Census of Manufactures for 1927, was in motors driven by purchased current: 19,132,310 hp., against 19,693,371 hp. from fuel and water power. Over half the latter was in turn also applied electrically through 11,206,979 hp. of motors driven by energy generated in the establishments reporting.

In the final form, then, more than three-fourths of the horsepower in American factories was electric at the end of 1927. The ratio is constantly rising. Today it is probably 80 per cent; and certainly purchased power now exceeds 50 per cent.

Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers to quote or use them for any legitimate purpose. While no acknowledgment is required, users will, by crediting the ELECTRICAL WORLD, help it in obtaining and compiling further basic information.

Horsepower of Prime Movers in American Industry 1927



Census Classification of Industry Groups

1. Food and kindred products.
2. Textiles and their products.
3. Lumber and allied products.
4. Paper and paper products.
5. Printing, publishing and allied industries.
6. Chemicals and allied products.
7. Products of petroleum and coal.
8. Rubber products.
9. Leather and its manufactures.
10. Stone, clay and glass products.
11. Iron and steel and their products, not including machinery.
12. Non-ferrous metals and their products.
13. Machinery, not including transportation equipment.
14. Transportation equipment, air, land and water.
15. Railroad repair shops.
16. Miscellaneous.

Material Increase in Southern Production

THAT the larger manufacturing plants in the Southern States are maintaining production on a high plane is indicated by data received by the ELECTRICAL WORLD on the consumption of electrical energy by about 550 manufacturing plants operating in this section, The May rate of productive operations was 1.4 per cent over April and 15.8 per cent over May last year. The slump in operations which has been witnessed during the late spring and summer months of past years does not seem to be present this year, and there are reasons for believing that operations will be continued on a high plane during the entire summer.

Index of Productive Activity in the Southern States

Average Monthly 1923–25 = 100
All Figures Adjusted for Number of Working Days

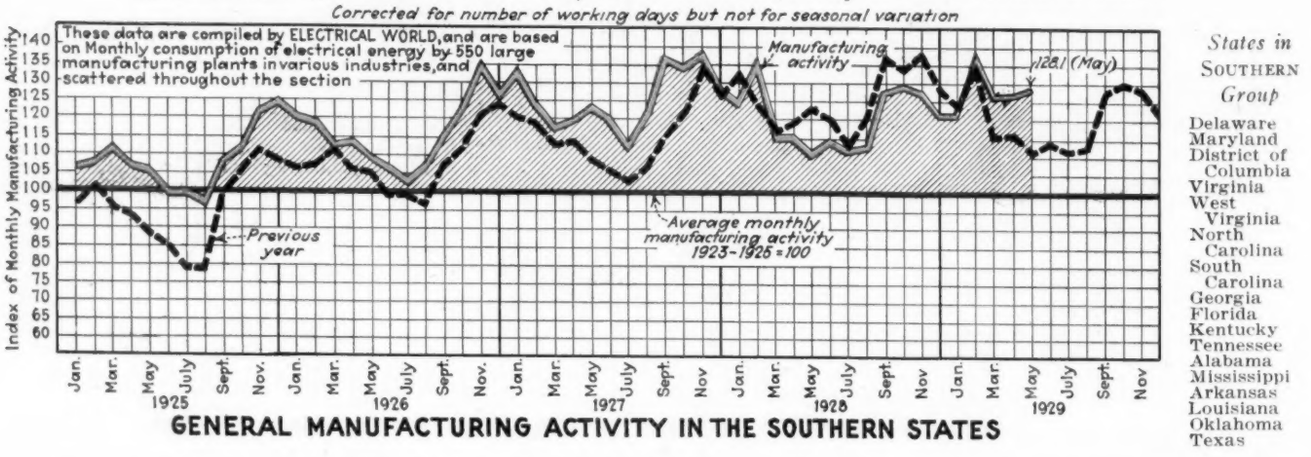
	May, 1929	April, 1929	May, 1928	Average for First Five Months, 1929	Average for First Five Months, 1928
All industry	128.1	126.3	110.6	127.6	120.2
Metal-industries group	187.3	173.6	105.2	181.2	118.5
Rolling mills and steel plants	239.5	200.2	125.8	224.8	134.2
Metal-working plants	130.5	143.7	82.4	133.1	102.4
Food and kindred products	146.0	118.1	118.0	132.2	118.7
Stone, clay and glass	163.8	187.3	200.0	162.1	188.6
Textiles	131.8	143.7	98.2	139.9	122.3
Paper and pulp	157.8	158.8	161.3	149.9	145.6
Forest products	78.8	73.3	84.8	81.1	101.0
Fertilizer industry	118.1	45.9	41.0	134.8	89.2
Shipbuilding	94.9	100.2	61.8	96.6	
All industry (United States)	136.9	136.4	119.0	136.4	120.5

Four of the primary industrial groups —rolling mills and steel plants, metal-working plants, food products and rubber products—have witnessed unusually large increases over last year. The iron and steel industry's rate of activity in May was 19.6 per cent over April and was 91.4 per cent over the month of May last year.

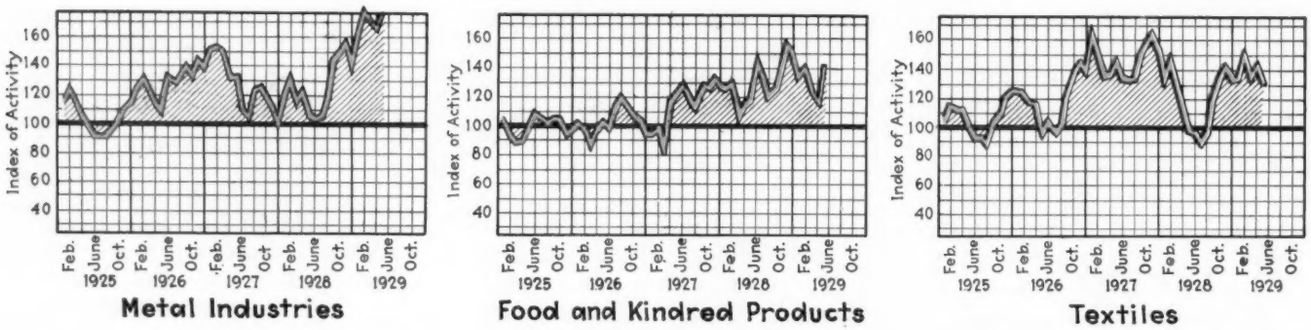
The current operations of these plants are more than double those recorded during July of last year. The ferrous and non-ferrous metal-working plants, while operating slightly under April, were still some 58.4 per cent over May last year.

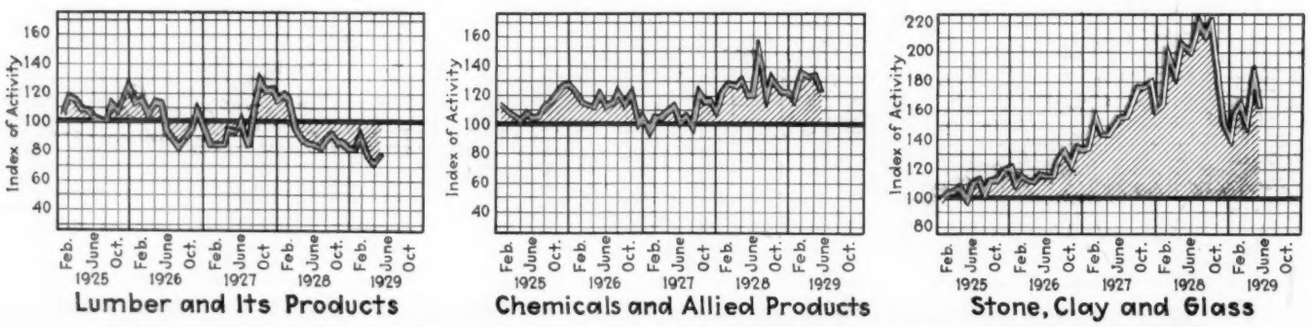
Materially improved conditions are reported in the textiles industry. The May rate of operations in these plants was 8.3 per cent under April, but was still 34.2 per cent over May last year.

ELECTRICAL WORLD *Barometer of Industrial Activity in the Southern States*



GENERAL MANUFACTURING ACTIVITY IN THE SOUTHERN STATES





MANUFACTURING ACTIVITY IN THE PRIMARY INDUSTRIES OF THE SOUTHERN STATES